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**IMPERIAL AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI**

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Feeding for milk at lowest cost per gallon

WHILST it is unwise to drag the last ounce of milk out of the dairy cow, it will be generally agreed that milk production is most profitable when the cow is giving her maximum yield compatible with maintenance of good condition.

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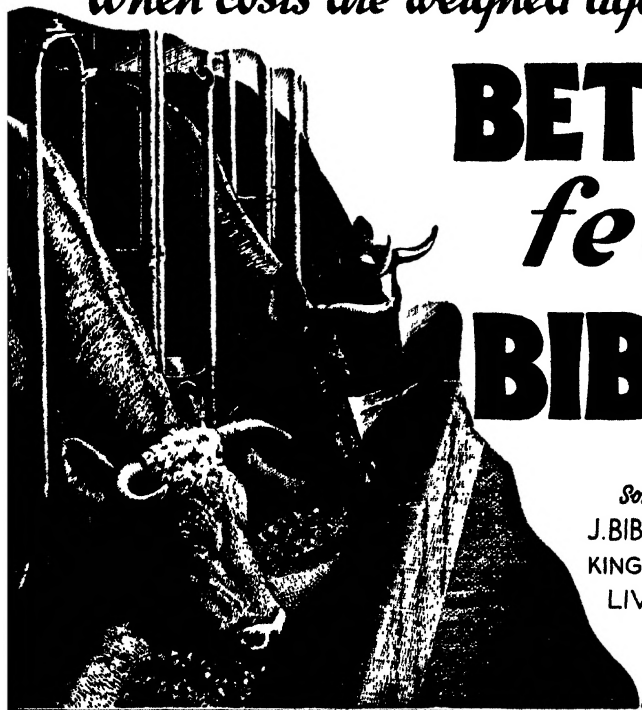
- through the cow never giving her maximum quantity.
- through the yield falling off too rapidly as lactation proceeds.

●through the cow wearing out and failing to produce a sturdy calf.

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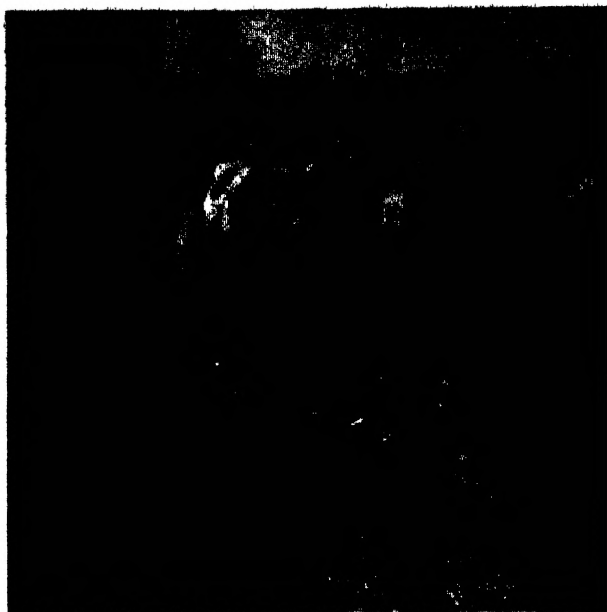
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CATTLE OUT AT GRASS



need a ration high in carbohydrates

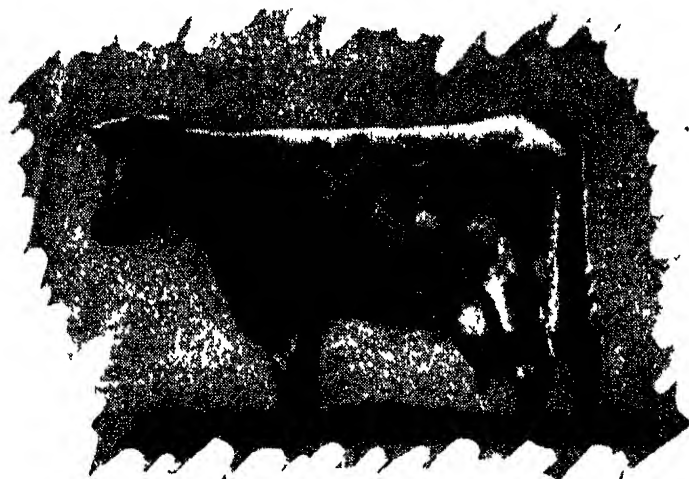
The old-fashioned method of feeding cakes high in fibre, to cattle out at grass, is rapidly diminishing. Recent experience has shown that a Cake with a high carbohydrate content is by far the more satisfactory feed for this purpose.

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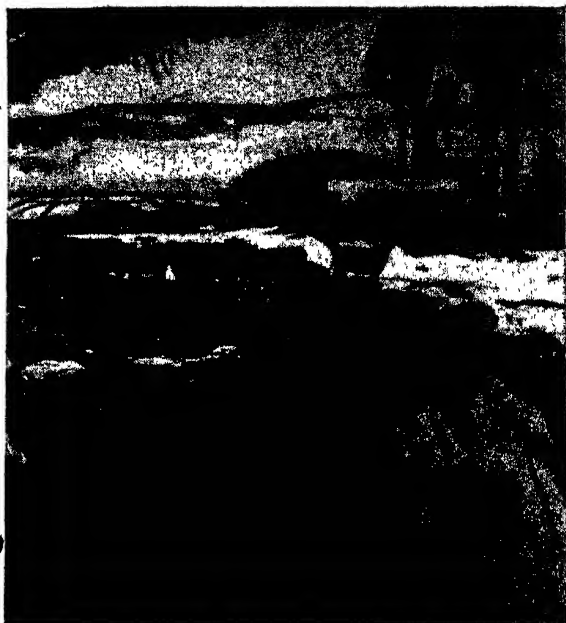
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to produce
FIRST CLASS
BEEF at
lowest cost
per pound?*



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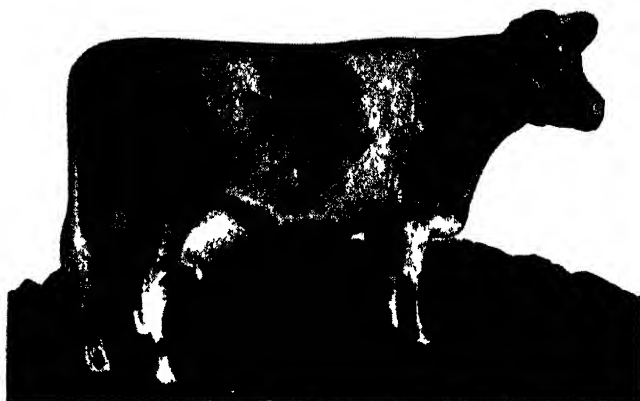
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ROUND THE SHOWS OF 1937 (No. 4.)

THE ROYAL COUNTIES SHOW



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Under the management of Mr. R. Passingham the "Red Rice" herd of Dairy Shorthorns has become well known for the excellence of its stock. It is worthy of note that 8 heifers, having recently completed their lactation period, averaged 9,933 lbs. of milk. The herd is also noted for uniformity of type and hardy constitution which, coupled with an average yield of 10,124 lbs., has led to ready sales at home and abroad. For maintaining health and promoting a high milk yield at all seasons of the year, Mr. Passingham insists that the rations contain

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CHAMPION DAIRY COW at LONDON DAIRY SHOW



"BARBOIGH LILIAS 28th."

The property of our esteemed customer, Alexander Watson, Esq.,
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Some interesting records of this cow are as follows:—

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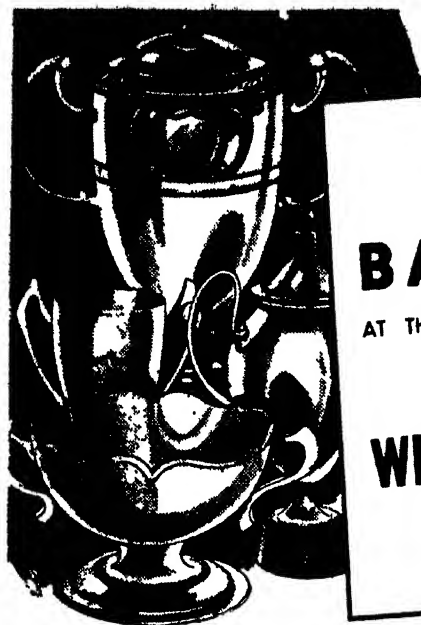
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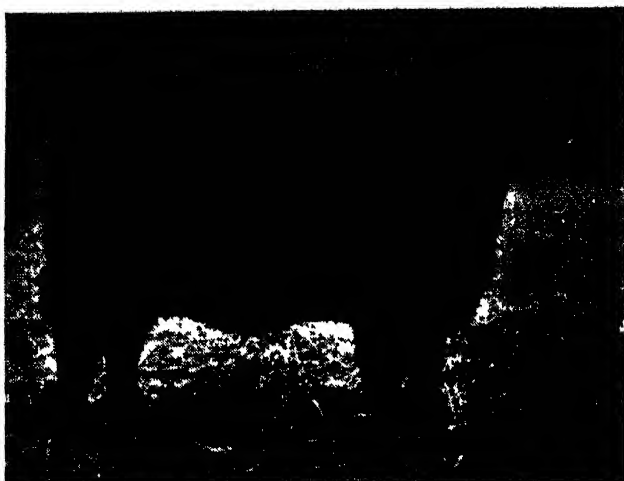
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"For the past thirty years I've fed Bibby's 'Milk Cakelettes' to all my young stock and have won more prizes for females at Perth Spring Sales, pure breeds, than any other breeder. Last two years, 13 yearlings averaged £110—so that's all right."

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THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XLIV

No. 1

April, 1937

NOTES FOR THE MONTH

Weed Destruction

APART from spring cultivations that may be directed to weed destruction and the preparation of a clean seed-bed for sugar-beet, root and other crops generally, a good deal may be done towards weed destruction by spraying cereal crops with a solution of sulphuric acid or sulphate of ammonia, or dusting them with cyanamide.

There is plenty of evidence to show that these methods are very successful in destroying the bulk of Charlock and many other annual weeds, and so reducing the distribution of further weed seeds upon the land. Another advantage is that the reduction in weeds will surely add to the yield of cereal straw and grain. In addition, where the corn crop is in need of nitrogen the sulphate of ammonia or cyanamide used will provide what is required. If, however, the land is in good heart, and an increase in nitrogen may tend to make the crop "go down"—as where land has been sheeped—it will probably be better to use sulphuric acid for weed destruction.

Sulphate of ammonia may be used at the rate of 1-1½ cwt. in 80 to 100 gal. of water per acre; sulphuric acid is most commonly used as a 7 to 10 per cent. solution, or 7 to 10 gal. of Brown Oil of Vitriol (B.O.V.) in 93 or 90 gal. of water per acre; cyanamide is distributed, preferably by a blower, at the rate of 1-1½ cwt. per acre. The sprays may be used at any suitable time up to the end of May, and, if the corn is not too high, even into the first or second week of June. Cyanamide, however, should be applied somewhat earlier, preferably when Charlock has four rough leaves, or the cereal is no more than six inches high. It is best to carry out the treatment during a spell of fine weather, though as far as the spraying is concerned heavy dew or slight rain will matter little, while it is desirable to apply cyanamide early in the day when the dew is on the leaf.

NOTES FOR THE MONTH

This brief note is intended merely as a pointer to indicate the possibilities; farmers who have seen the results of correct treatment at the right moment, will appreciate the value of what has been done. It may be added that those who have not hitherto made use of these methods of weed destruction in cereal crops, but desire to do so this season, may safely follow the advice of the agricultural advisers of the organizations that direct the distribution of the three materials in question; they may in the first place prefer to consult the Agricultural Organizer for their county.

The Output of Glasshouse Crops

In the early part of last year the Ministry undertook a special inquiry into the output of crops grown under glass in England and Wales during 1935. The main features of the results of the inquiry were published in the Ministry's Agricultural Market Report for February 26, 1937; the following is a summary:—

The total number of forms dispatched was 15,118 compared with less than 8,000 in 1931 and about 6,000 in 1925. Replies that could be tabulated represented about 42 per cent. of the forms dispatched and approximately one-half of the total glasshouse area of the country. On the basis of these replies the total area of glass is estimated to be about 3,360 acres, including 3,100 acres of glasshouses and 260 acres of frames, compared with a total area of 3,150 acres in 1931. It is estimated that 59,000 tons of tomatoes, 75 million cucumbers and 2,030,000 lb. of grapes were sold in 1935 as against 54,000 tons, 54 million and 1,150,000 lb., respectively, in 1931. No quantitative estimate of the output of flowers, etc., is available, but the estimated values of the various crops sold in 1935 compared with the two earlier inquiries, which are given in the following table with the proportion of the total values represented by each crop, indicate that the output of the flowers, etc., group represents an increasing proportion of the total output.

Inquiries were also made as to the labour employed and the cost of fuel used in the industry during 1935. From the replies received to these questions it is estimated that 41,100 workers were employed during the season although it seems probable that to some extent this figure includes workers who would be employed for part of their time on other agricultural operations. Of the paid workers, 27,000

NOTES FOR THE MONTH

were regularly and 8,800 casually employed, while unpaid family or other workers totalled about 5,300. The fuel bill of the industry in 1935 is estimated at approximately £880,000.

Description	1925		1931		1935	
	Estimated Value	Proportion of Total Value	Estimated Value	Proportion of Total Value	Estimated Value	Proportion of Total Value
	000 £	%	000 £	%	000 £	%
Fruit and Vegetables :						
Tomatoes	2,350	49	2,190	39	2,520	36
Cucumbers	750	15	770	14	800	12
Grapes	130	3	90	2	145	2
All others	250	5	230	4	295	4
Flowers, Foliage and Plants	1,350	28	2,290	41	3,205	46
TOTAL	4,830	100	5,570	100	6,965	100

Agricultural Statistics, 1935 (Part II)

THE Ministry's Annual Report on the prices and supplies of agricultural produce and requirements was published at the beginning of March. The Report discusses the movement in prices and changes in the source of supply of the principal agricultural commodities in the year 1935, in comparison with those in previous years. The Report shows that the improvement in the general price level of agricultural products that was recorded in 1934 was continued in 1935. The general index of prices reached 117 and was thus 3 points higher than that for 1934. The group index for live stock and live stock products showed a decline of 1 point. The index for the cereals and farm crops group rose by 4 points, while that for fruit and vegetables rose to 184, an increase of 52 points above that for 1934, and was the highest index for this group since 1922. In addition to the usual tables, three diagrams are included, showing a long-term comparison of the prices of British and certain imported oats, the changes between 1899-1900 and 1934-35 in the home production of beef, and the index numbers of the prices of fat and store sheep for the years 1911 to 1935. The review of the quantitative regulation of imported produce contained in the Report for 1934 has

NOTES FOR THE MONTH

been brought up to date, and the recent changes in Customs duties are included in an Appendix that shows in detail the period of operation, amount of duty, etc.

Copies of the Report, which forms Part II of the Agricultural Statistics, 1935, may be purchased through any bookseller, or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, price 1s. 6d. net, or 1s. 8d. post free.

Agricultural Indebtedness

THE *Monthly Bulletin of Agricultural Economics and Sociology** is publishing a well documented study on Agricultural Indebtedness. The first part of this study appeared in the January, 1937, number of the Bulletin and is divided into two sections, the first of which deals with the problem of Agricultural Indebtedness in general, showing its progressive development after the War, its structure, its old and recent causes, its consequences and aggravation following the world economic crisis. Section two consists of a survey of the measures taken by the various Governments to meet this situation and of the results of these measures. It is compiled on the basis of data gathered from credit institutions and special researches, and deals concretely with the indebtedness problem and the means by which efforts have been made to lighten its effects in the following countries: (A) Central and Western Europe: Germany, Belgium, France, Italy, Switzerland. The February issue of the Bulletin continued the study and dealt with (B) Scandinavian countries and Finland: Denmark, Norway, Sweden, Finland. Other countries to be dealt with in following issues are: (C) Central and Eastern Europe: Bulgaria, Greece, Hungary, Poland, Rumania, Czechoslovakia, Yugoslavia; (D) Baltic countries: Latvia, Lithuania, Estonia; (E) Asiatic countries: India, Japan; (F) North America: Canada, United States; (G) South America: Argentina, Brazil; (H) Australia.

This study is related to the methodical work of observation and analysis on economic conditions of world agriculture in general—work the results of which are to be found in the annual volume published by the International Institute of Agriculture: *The World Agricultural Situation*.†

* Published by the International Institute of Agriculture, 1, Villa Umberto, Rome. Obtainable from P. S. King and Son Ltd., 14, Great Smith Street, London, S.W. 1, price 15s. 6d. per annum.

† Obtainable from P. S. King and Son Ltd., price 10s.

NOTES FOR THE MONTH

National Institute of Agricultural Botany

THE seventeenth Report of the National Institute of Agricultural Botany is now available, and copies may be obtained on application to the Institute. The work of the Institute is directed to supplying the farmer with unbiased information as to the seeds he sows, and the report deals with methods by which this information was obtained in 1936.

New varieties of all farm crops are tested by the Institute as soon as they appear, the trials being conducted on a field scale at six permanent stations in England, and in some cases at additional centres on a farmer's own land. In all instances the varieties are grown as they would be by the farmer himself. Every feature of the varieties is noted and the results are of considerable value. For instance, of all the new varieties of winter wheat that have been tested in the last ten years, only one has proved to be worthy of general recommendation by the Institute. This is the Dutch variety Juliana, which has in the past two years' trials given slightly better results than Wilhelmina.

The position with other crops is very similar, and it is clear that farmers will be well advised, before deciding to grow a new variety, to apply to the Agricultural Organizer for their county, or direct to the Institute, for information as to the merits of the variety in question.

Bibliography of Literature on Agricultural Meteorology

THE Ministry has issued a third mimeographed Bibliography of Literature on Agricultural Meteorology in continuation of previous works published in 1932 and 1936, the former of which is no longer obtainable. It is not claimed for the present bibliography that it is a complete reference to papers, etc., dealing with agricultural meteorology; it consists of the titles noted in the Ministry during the ordinary course of the administration of the Agricultural Meteorological Scheme from the perusal of the original periodicals, digests, and other sources. The titles so noted between October, 1933, and the end of September, 1936, are included.

The bibliography has been widely circulated, both in Great Britain, in the Dominions and Colonies, and elsewhere overseas. A few copies of the second and third bibliographies are available, gratis, to workers and others interested.

NOTES FOR THE MONTH

Applications should be addressed to the Secretary, Agricultural Meteorological Committee, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

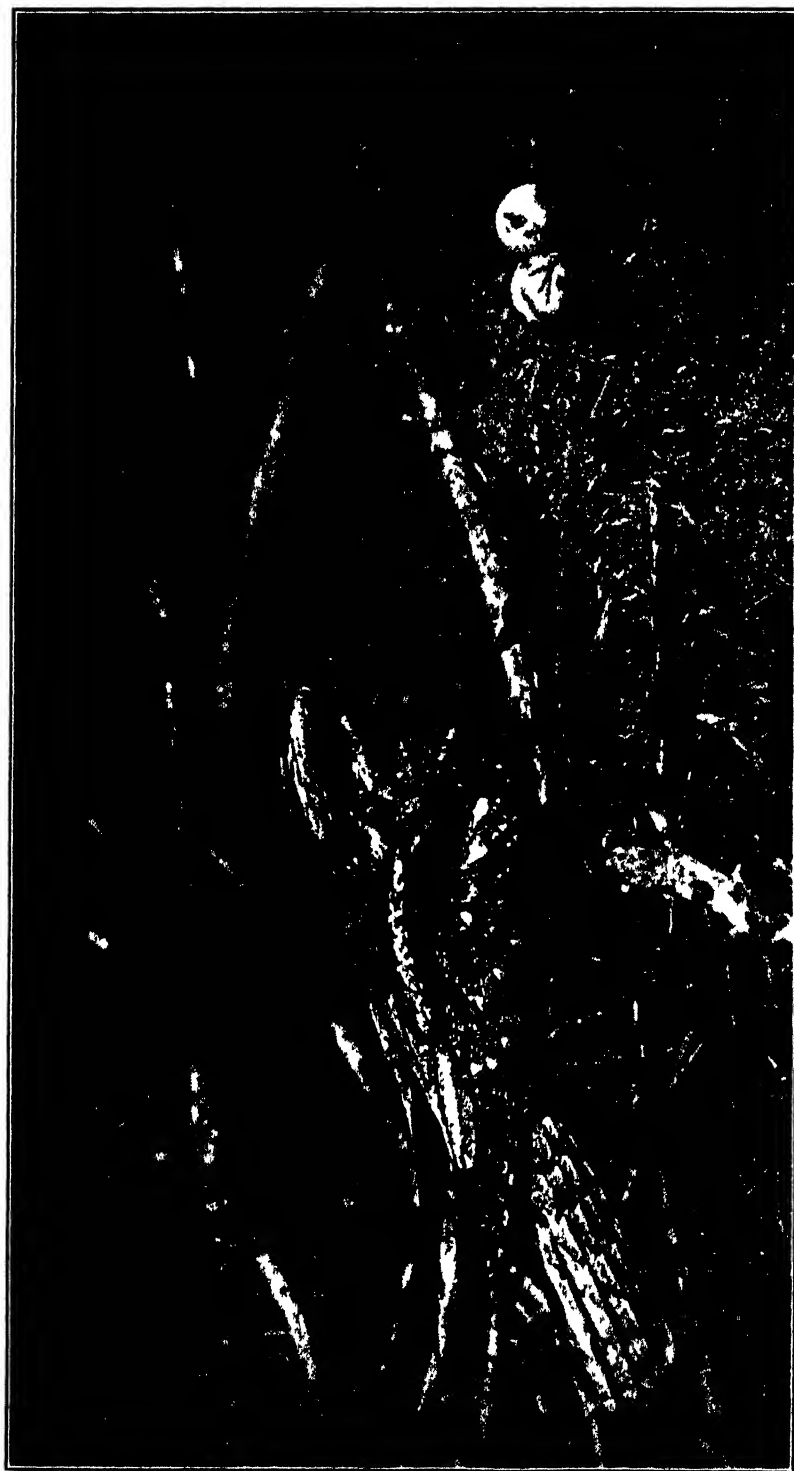
Interesting Birds : (2) The Nightjar

THE Nightjar is one of the most notable of our birds, being not only of interesting and peculiar habit, but valuable to the agriculturist. It is, in fact, one of the most useful of all our summer visitors, and it is unfortunate that it has been burdened with certain local names that are likely to convey a false impression as to its real character. The names " Fern Owl " and " Night Swallow " are not objectionable, and are indeed rather apt, since the bird is of nocturnal habit, has a swallow-like flight, and is often found in clearings and on commons where bracken is plentiful. " Nighthawk " and " Goatsucker," however, are misleading. The former name suggests that the bird is of a predatory nature and likely to be a menace to young poultry and other birds. The latter has its origin in an absurd belief that the bird sucks milk from goats, a belief that is, of course, entirely erroneous.

In a quiet way the Nightjar is a handsome bird, its plumage being beautifully mottled with black and various shades of brown and grey. When at rest during the daytime, this colour scheme makes the bird difficult to detect, especially when perching on the branch of a tree. It lies lengthwise along the branch and not across it as do most other birds. In such a situation it is easily mistaken for a fungoid growth or a woody excrescence.

The Nightjar does not make a nest, but lays its 2 eggs on the bare ground, usually on a heath or a common or in a clearing of a wood. The eggs, which are elongated oval in shape, with very little difference between their ends, are prettily marbled with brown, lilac and grey.

The food of the Nightjar consists entirely of insects. The bird does much good work by destroying noctuid and other moths, many of which are harmful to agriculture, cockchafers, and other injurious insects. Its large, hair-fringed mouth is especially well adapted for the capture of these. In any list of beneficial birds the Nightjar would rank highly. It is never common in this country, and should be encouraged and protected in every possible way.



Photograph Ern. I. Hosking.

Nightjar with Eggs

NOTES FOR THE MONTH

Sugar-beet Seed

THE following note has been communicated by the National Institute of Agricultural Botany:—

The Institute has conducted field trials with sugar-beet strains over a period of 11 years in the most important beet-growing districts of England. The results show that certain strains are superior to others on the basis of sugar yields, and also clearly indicate that some are more suitable than others for special circumstances, such as early sowing or for growing on very rich soils. It should, however, be pointed out that although the Institute's trial centres are in typical beet-growing areas it is obvious that they cannot represent *all* classes of soils within each area. For this reason, although the results have been found of very wide application, it is advisable for growers to ask advice of the Factory Agriculturists whenever special conditions have to be met. Every grower should, therefore, give careful attention to the choice of strains, and in taking advantage of the wide choice of seed offered by factories, should be influenced by the recommendations of the N.I.A.B. and the Factory Agricultural Departments.

The following strains have given high sugar yields in addition to satisfactory field behaviour and can be recommended for general cultivation: Kleinwanzleben E, Sharpe's English-grown Kleinwanzleben E, Kleinwanzleben N, Marsters British Hilleshog, Johnson's Perfection, Kuhn P, Dippe E, Dippe W.I., Strube E, and Hoerning H.S.; Dobrovice N, and Zapotil N have also, in certain areas, proved their merits as reliable strains.

Non-bolting strains have a special value for early sowing. Marsters British Hilleshog has proved almost completely resistant to bolting, and Kuhn P is almost as good. Johnson's Perfection, Kleinwanzleben E, Sharpe's Kleinwanzleben E, Kleinwanzleben N, and Sharpe's Kleinwanzleben N, have also been fairly free from bolters even when sown early. For districts where conditions are usually very favourable to bolting, the Institute recommends Marsters or Kuhn P for the earliest sowings.

For early lifting, any of the strains mentioned in the preceding paragraph will do well when sown early. The best "E" strains give good sugar yields even when lifted early, but they are more suitable for late lifting since their great

NOTES FOR THE MONTH

vigour and continued late growth lead to a still higher sugar yield when lifting is deferred until, say, the middle of November.

Large topped strains are apt to be troublesome on very rich soils. In recent trials in the Fens, Marsters, which has the smallest tops, and Kleinwanzleben E, although a large topped variety, gave the best results, followed by Kleinwanzleben Z, Kleinwanzleben N, Johnson's Perfection, and Kuhn P. The last two have larger tops than Marsters but smaller ones than the Kleinwanzleben strains.

All the above strains are ultimately of Continental origin and much of the seed used here is grown abroad. Trials have, however, shown that English seed produced from stocks of the above-mentioned Continental strains gives just as good results as foreign-grown seed, provided it is properly grown and harvested under good conditions.

Last year, preliminary observation plots were grown of two strains of seed of Russian origin. These proved to bolt badly. It is understood that other Russian strains will be introduced in the coming year in the hope that they may prove to be less prone to this defect. For growers who buy Russian seed it is suggested that it be used for the later sowings.

Fuller particulars of the leading strains are given in a leaflet that may be obtained free of charge from Factory Agriculturists, County Agricultural Organizers, or direct from the Institute, Huntingdon Road, Cambridge.

The Official Seed Testing Station in 1935-36

THE Report* for the year 1934-35 shows that, during the twelve months ended July 31, 1936, the Official Seed Testing Station tested 29,870 samples from outside sources. This is the highest number ever tested during the twelve-month period, and compares with the 1934-35 total of 28,327, itself a record figure. In addition, 2,035 samples were dealt with in the course of various investigations.

SEED-BORNE DISEASES. Celery seed samples were again submitted to the Station for examination for the presence of seed-borne diseases, and of the forty samples examined, only three were found to be free from infection with *Septoria apii*

* The seventeenth Report of the National Institute of Agricultural Botany, Cambridge, 1935-36.

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(celery leaf-spot). Twenty-four contained up to 10 per cent. and six contained more than 60 per cent. of infected seed. Over half the samples were free from infection with *Phoma apicola* (Phoma root-rot) and in only one instance did the degree of infection reach 10 per cent. Fifteen samples contained from 1 per cent. to 9 per cent. of infected seed.

Several samples of wheat were received, to be examined for adhering spores of Bunt (*Tilletia caries*). *Helminthosporium avenae* developed upon a number of oat samples during the course of the routine germination test, and special examination, upon request, was made for the presence of this organism in a few samples. *Ascochyta pisi* was recorded on a relatively large number of pea samples, and samples were submitted for examination for "Marsh Spot." Specimens of bunt balls, ergots, and earcockles were received for identification, with requests for information concerning the organisms responsible.

Organic mercury compounds in the form of seed dressings have become widely used for the control of certain seed-borne diseases of cereals, and are in certain instances likely to be of protective value when applied to other seeds. From inquiries received from time to time, it is evident that little is known with regard to their relative toxicity to seeds other than those of cereals, sugar-beet, mangolds, and peas, and work has now been commenced to investigate the toxicity of such compounds to the smaller seeds.

Work has already been done to determine the effect upon the "keeping quality" of cereals, after having been dressed with organic mercury compounds, and this work is now being further extended.

MOISTURE CONTENT OF SEEDS. The services of the Station in determining the percentage moisture content of seed samples were taken advantage of to a greater extent than in any previous season, a total of 251 samples being submitted for this purpose. The majority of these samples were of sugar-beet seed, some eighty samples coming from beet sugar factories. The moisture content of seed plays a part in fixing the price of certain seeds, and is of importance in connexion with field trials. It is, however, perhaps not fully appreciated how great a part the moisture content plays in the complex question of loss of vitality of seeds. Too high a moisture content of stored seed, apart from the obvious risks, invariably leads to rapid loss of vitality, and in this connexion the

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Station has in course of preparation data showing the average moisture content of air-dry seed of most of the species listed in the Seeds Regulations.

WILD WHITE CLOVER CERTIFICATION SCHEME. During the season under review, the number of "head" samples collected from pastures inspected under the scheme and received at the Station reached 15. A further 24 were received during August of this year, bringing the total of plots sown down from "head" samples since 1930, to 914. In addition, type samples from pastures finally certified under the scheme have been sent to the Station and plots sown down from them for checking purposes, a total of 103 such samples having been received since 1931.

PEAS. From time to time the Station is asked to conduct greenhouse soil tests upon pea samples in addition to tests by the standard laboratory method. To be of value, such tests should be conducted in a uniform manner under properly controlled conditions and in this connexion many tests have been made upon bulks of peas of varying quality, in order to compare results by the standard sand method with those from tests made under various "greenhouse" conditions. The effects of a number of factors, such as depth of planting, nature of medium, and degree of moisture of seed bed, have been investigated.

Arising from an inquiry concerning a crop failure, an investigation was undertaken to determine the toxicity to peas of those arsenical salts and compounds available to the public. It was found that in certain concentrations arsenic in some forms is highly toxic to peas.

Plant specimens in considerable number were received for identification during the year. In addition, almost every week during the season the Station received seeds for identification, with requests in a number of instances for notes upon the species concerned.

LIVESTOCK INDUSTRY BILL:

Livestock Markets and Central Slaughtering

Two important parts of the Livestock Industry Bill, namely, Part IV dealing with livestock markets, and Part V relating to slaughtering, have aroused widespread interest. The following extracts from statements made by the Minister during the discussion of the Bill in the House of Commons and in Standing Committee give a general indication of the intention and scope of these parts of the Bill.

Part IV. Livestock Markets. [SECOND READING—January 20.] I now wish to turn to the proposals for dealing with livestock markets. Though it is a difficult problem, from which Governments have at times shrunk in the past, some reform is overdue. It has been mentioned by commission after commission and committee after committee that the redundancy of markets inflicts damage upon producers. . . It is 90 years since the House passed a Markets Act, and in those 90 years immense changes have taken place. . . What is the object of a market? Its object is to attract a sufficient number of potential buyers, so that there shall exist healthy competition between those buyers to secure the produce which is offered for sale, and it is obvious that where there are small and redundant markets there is no real competition; there is not a real market at all and the producer suffers. There are other ways in which markets need improvement. Some of them do so little business that they have not been properly equipped, though the equipment of a market is often a matter of vital importance to the producer and may in the end affect the return for his labours. Many markets are to this day shackled by ancient charters. In some cases there may be two markets in neighbouring towns, and even in the same town, taking place at the same time, and distributing between them business which is only sufficient for one.

I am anxious not to overstress this problem of redundancy. The question is not one of dealing with the small market, necessarily, but with the market which is redundant, that is, a market the continued existence of which operates against the interests of producers. It is a regional problem; it depends

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on the demands of the area whether a market is redundant or not, and the Bill proposes that the commission shall make recommendations for dealing with the country area by area. Ample safeguards are provided. . . . I am anxious that the House should realize that the important part about the proposals is not the closing of markets, but an improvement in the efficiency and equipment of the vast majority which will remain. We propose that the Commission should be given power to deal comprehensively with equipment, and also to make by-laws specifying matters which make for efficiency and fairness in the markets.

[COMMITTEE—March 4.] *Powers of Commission.* The Commission cannot close any market at all. They have no power to close a single market in this country, and they will not have any such power when the Bill becomes law. That is the first point that I would like hon. Members of the Committee thoroughly to grasp. All that the Commission can do is to survey the problem area by area, and make proposals for the better equipment and better regulation of markets within the area. The proposals have no force at all until they are confirmed in a livestock markets order. The authority of the Minister, and, if it is opposed in any way, the authority of Parliament, is necessary before a single market can be interfered with. That is an important and fundamental fact.

When the enabling character of this legislation is thoroughly grasped, I venture to think that many of the quite legitimate apprehensions which are felt in many parts of the Committee as to the powers of the Commission will be dissipated. When you are framing enabling legislation, when you are setting out to tackle this great and urgent and long delayed problem of markets by an instrument which can act by way of making proposals for a reform, what do you do? You draft your enabling legislation so that the Commission may take into consideration such-and-such questions, and you draft that part as widely as possible, remembering that by so doing you are not conferring wide powers of executive action upon the Commission, but are merely enlarging the sphere which they can survey in order to make their proposals. It is quite a different procedure when you are setting up an executive body which by its own authority has power to interfere with the normal life of citizens in this country. Then, quite rightly and properly, Parliament is jealous of delegating executive rights to interfere with people without putting in stringent safeguards.

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The safeguards here are complete to the last degree. I doubt whether any draftsmen could have devised words more apt to ensure that no legitimate interest can be affected without the fullest consultation, the fullest discussion, and the fullest resort to Parliamentary opposition up to the very last stage. If anyone can suggest improvements in that machinery, we shall be very glad indeed to consider them, but I would ask the Committee to remember that Parliament is the authority all the time, that in the matter of these livestock markets orders the Commission's power is to survey and make proposals.

For that reason, the Committee would not be advised by me to insert in the Clauses of the Bill any provisions which would tend to limit or restrict the area which the Commission can survey, or to knock out from their consideration certain factors which may become vital for a proper execution of their duties. Our object in adopting this procedure at this stage is to set up an instrument which will relieve Parliament from having to legislate again on this subject in specific instances for a long time, while at the same time maintaining to the full the control of Parliament over the specific proposals made by the Commission. I think it would be very unwise, seeing that this legislation is to be of a permanent character, to put in too many restrictions upon what the Commission's proposals may contain. A proposal which in this year of grace may look a little drastic, may, at some time or other, not appear so. Realizing that full control is kept, I would ask the Committee not to insist upon restrictive amendments limiting the power of the Commission to make proposals. Let them make their proposals, and let us deal with the proposals on their merits when they come.

Redundant Markets. I have tried to make it clear that it is not the size or the turnover of a market which is the distinguishing feature of its usefulness to the community. If you are in a remote district, as in some parts of Wales, two small markets may exist at a very short distance from each other as the crow flies. Men and cattle certainly are not crows and have not the power of flight, and the two markets may be separated by some mountain range, lake, or some other natural barrier, which makes the journey between them a very long one. In remote districts of that character, it is often necessary for a small market to continue to exist, if the operations of agriculture are to be conducted with facility and

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ease. The only thing that is aimed at is the market which is redundant on its merits, having regard to all the facilities existing in the neighbourhood and the circumstances of each locality. It is for that reason that the Commission propose to proceed area by area, to take in precisely those local factors which determine whether or not a market is of service to an agricultural community or merely a load on the backs of the producers in the district.

I hope that my hon. Friends will see that in this Part of the Bill there is no object to be attained by limiting in any way the sphere of action of the Commission, remembering that the authority remains where it must remain, with the Minister, and with Parliament in the long run.

Part V. Slaughtering of Livestock. [SECOND READING—January 20.] I pass to the slaughtering provisions of the Bill. In the discussions which have taken place, some people have said that centralized slaughtering is the key which would unlock the door to the whole problem of the live stock industry. Others have held that while centralized slaughtering has worked with remarkable proficiency in South America, such conditions did not obtain in our country, and they were disinclined to believe that there was anything in the idea. The Government believe that there is certainly enough in the idea to warrant an experimental approach to the problem.

[COMMITTEE. March 18.] The ordinary public slaughterhouse run by a local authority really consists of a common roof provided by the authority under which butchers come to slaughter their own beasts in separate pens as they require the facility. This is something different. It will have all the advantages, from the point of view of public health, of the central slaughterhouse conducted by a local authority, but it will have the added advantage that we shall try to do something to meet the economic position of the producer, of the butcher, and of the consumer by using more modern methods, and by bringing to this highly skilled technical process the best assistance which modern inventions can bestow. Because we are all interested in public health, if we add these additional advantages to these three slaughterhouses it is no reason why they should be any worse; it is an added virtue in them, and I would commend the experiment on that ground to the Committee. Of course, the slaughterhouse run by the public authority at the present time for

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reasons of public health is necessarily confined to its own civic boundaries for the area in which it can prohibit the competition of private slaughterhouses. This is not the same thing. The area will depend upon the scheme, upon what it is intended to produce as a throughput, and can only be judged in the light of the circumstances. I would ask the Committee clearly to distinguish, as I have previously asked them, between this Part of the Bill and the one which preceded it. The other is a permanent regulation of markets in the country; this is merely a provision to let us try out these three experiments in the slaughtering of animals.

There has been some talk about what can be dealt with by the slaughterhouse and what cannot. This Bill confers upon nobody any power to trade in meat. . . . I wish to make it clear that under the system which we imagine will come into operation the butcher who brings his beast to the slaughterhouse will have control over it; that is to say, he can get his own beast back at the end of the process, plus any offals of an edible character which he wishes to take away for sale in his shop. But it is evident that you cannot treat things like blood, scraps, and bile on an individualistic basis; they must go into a common pool and be sold for the purposes for which they are best suited. . . .

There has been so much criticism of the Bill made by those who fear that their interests in the butchering trade will be affected. I have dealt with the matter of the power to trade. If the body which comes forward with a proposal for a slaughterhouse already possesses the power to trade, under the common law there is nothing in this Bill as it stands at present which takes away that power. If, on the other hand, it is not a body which possesses that power, there is nothing in the Bill which confers the power upon it.

With regard to local authorities, who will be interested in the matter, although we have given them certain powers, they have not been given the power to trade in meat, even if they have one of these schemes. The question whether or not the power to trade in meat is a thing which may be included in the scheme would arise in this way and at this point of time. The Commission would have before it, and the Ministry would have to approve, proposals of different characters. If a proposal were made in circumstances in which trading in meat would be against the public interest, I should imagine that that would be a case where the Commissioners and the

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Ministry would regard the scheme with a certain amount of examination to see that no legitimate interest was involved; but it is at that stage and not during the discussion of the Bill that the question would arise for solution. . . .

The initiative for the commercial proposal must come from some local body. When the Commission have examined the proposal and made up their mind that it is a good one the Commission bring the scheme into operation to safeguard the proposal and to make it a commercial proposition. It is quite obvious that no one would come forward with a proposal of this character without knowing what powers he was going to get out of the scheme, and really it is true to say that nothing can happen without the initiative of some local body.

One hears talk of confiscation of property and so on. I would say that there is nothing about that to be found in any part of the Bill. The process of slaughtering is a matter with which we are very familiar. In Scotland power is given to close down a private slaughterhouse in a town once the central slaughterhouse is provided, and that without compensation. That will not be the case here. One has heard a good deal about the effect of this process upon meat. I think that that discussion would be more apt from the point of view of a discussion of whether central slaughtering was a good thing or not. That is not exactly the question before us. The question is: Is central slaughtering sufficiently interesting from the point of view of the producer to allow experiments to be made to ascertain the facts? That is the point with which we are confronted in this Part of the Bill, and not with its effect upon meat. I would say in this connexion that, in my view, there is nothing to show that meat treated in this highly specialized manner suffers in the least degree. . . .

Now with regard to the suggestion of transport difficulties, I venture to think that it is exaggerated. People have spoken as if the Bill is going to upset transport arrangements to a revolutionary degree. The municipal central slaughterhouses which exist to-day for reasons of public health take no account of that difficulty, and no one has suggested that we should abandon that method of preserving public health. Modern slaughterhouses to-day are never sited with primary regard to the convenience of the producer and the transport ease of the situation. It would be quite possible for slaughterhouses to be so situated in this country that that difficulty would not arise. These are matters which will have to be taken into

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consideration when the scheme is before the Commission. I would say also that we should not in any way be put off by threats that there will be a great increase in the consumption of foreign meat. I am myself convinced that if our own meat is given a good chance, with facilities which are available to our competitors overseas, it will prove to be of as fine a quality; and I would remind Members that the time when there was an unrestricted supply of that commodity has gone.

I do not wish to make a speech justifying central slaughtering. I would ask the Committee to agree with me in this, that at least there is a case for an experiment. I do not think there are many hon. Members of this Committee who really object to this. Do they say that nothing should be done about this problem at all when it has been reported upon by Committee after Committee drawing attention to this matter? Do they say that the slaughtering of animals in this country is conducted in such an efficient manner that it cannot be improved? I am sure no one could say that. Would anyone say that the case against central slaughtering is so clear that no experiment should be conducted for this purpose? I am sure there is no one who would assert that it will react against the interests of owners of livestock. Does anyone say that we are going too far by this particular proposal? If not, then I would ask hon. Members of the Committee to devote their attention, which I shall greatly appreciate, to helping me, in the course of the discussions which follow, to make this scheme, which on its present lines is so abundantly justified, more workable for the purpose which we are all agreed should be followed.

COUNTY COUNCIL SMALL-HOLDINGS IN DORSET AND HAMPSHIRE :

I. DESCRIPTIVE AND SOCIOLOGICAL

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WHILE there may be grounds for genuine differences of opinion about the wisdom of extending land-settlement in this country, there can be no doubt about the need for taking every step possible to improve the financial and economic well-being of the smallholders already established on the land. Finding out what type of smallholders and what kind of small-holdings are proving most successful under existing conditions appears to be an essential step in this direction. It was for this purpose that the group of investigators associated with Lord Astor requested and enabled the Agricultural Economics Department of Reading University to conduct a comprehensive survey of existing county council small-holdings in Dorset and Hampshire. The Department has to thank Lord Astor and his colleagues for their financial assistance, and for permission to publish this summary of the findings. It has also to thank the County Land Agents and their staffs in the two counties for their invaluable help throughout the course of the inquiry. The inquiry itself could not have proceeded without the willing co-operation of the many smallholders who placed the results of their financial experiences at the disposal of the investigators.*

The Sample Studied. The first step in the inquiry was to make a preliminary statistical analysis of the statutory small-holdings in the two counties according to acreage and type of farming. This analysis covered a total of 853 holdings—616 in Hampshire and 237 in Dorset. It revealed a striking difference in the type of small-holding that had been encouraged in the two counties. In Hampshire there is a preponderance of the very small holding devoted to fruit and market-garden production. In Dorset, on the other hand, the

* The field work of the survey was carried out by Messrs. R. P. Askew, B.A., H. T. Williams, B.A., and J. Harrison, B.Sc., of this Department. Mr. Williams was also responsible for the statistical analysis of the evidence collected.

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dairy holding of from 25 to 50 acres has been encouraged almost to the exclusion of all others. Thus, in Hampshire 82 per cent. of the holdings are *under* 10 acres and 84 per cent. are concerned with fruit and market-garden production, while in Dorset 80 per cent. are *over* 10 acres and 76 per cent. are dairy-holdings.

Between the middle of July and the end of September, 1935, information about their economic and financial results was collected from 215 smallholders in the two counties. These smallholders were distributed as follows:—

	<i>Hants.</i>	<i>Dorset</i>	<i>Total</i>
Dairy holdings	26	59	85
Market gardening and/or fruit-holdings	78	3	81
Poultry-holdings	21	—	21
Miscellaneous or mixed holdings . .	24	4	28
	149	66	215

It is obvious that dairying and fruit or market-gardening are the two main types, and that the bulk of the dairying holdings are in Dorset, while practically all the market-garden and fruit holdings are in Hampshire.

Length of Tenure, Ages and Social Origins. With the exception of 19, or 8·8 per cent., all the smallholders had entered on their present holdings during or since the War. The exact position is shown by the following frequency distributions of lengths of occupations of present holdings and of approximate ages of occupiers.

<i>Length of Occupation of Present Holdings</i>	<i>No.</i>	<i>%</i>	<i>Approximate Age-group</i>	<i>No.</i>	<i>%</i>
Under 5 years	47	21·9	Under 30	9	4·2
5 and under 10 years	55	25·6	30 and under 40	59	27·4
10 and under 15 years	94	43·7	40 and under 50	61	28·4
Pre-war	19	8·8	50 and under 60	60	27·9
			60 and over	26	12·1
	215	100·0		215	100·0

Of the 215 smallholders 182 were country-bred and 33 were town-bred. It is interesting to note that 11 of the town-bred persons were on poultry-holdings, a fact that may reflect the greater attraction of poultry-keeping to those with no previous agricultural experience. All but eight of the smallholders were married, and, in view of the great importance of the housewife on the small-holdings, it is

COUNTY COUNCIL SMALL-HOLDINGS

significant that 175 of the wives (84·5 per cent.) were country-bred.

Not only were the majority of the smallholders country-bred, but most of them had always been engaged in agricultural or rural callings. The following statement gives the occupations of all 215 smallholders previous to taking on their small-holdings :—

67 farmers' sons.	5 dairymen.
29 smallholders' sons.	3 builders.
17 farm-workers.	3 clerical.
17 army or navy.	3 thatchers.
9 gamekeepers.	2 butchers.
7 engineers.	2 labourers.
6 carpenters.	2 bakers.
5 farm-managers.	2 motor-drivers.
5 farming abroad.	2 electricians.
5 gardeners.	2 policemen.
	2 shopkeepers.
1 each, shepherd, nurseryman, groom, blacksmith, postman, publican, salesman, cheese-factory worker, grocer, motor-mechanic, painter, auctioneer, dock-labourer, warehouseman, sailmaker, bricklayer, timber-feller, tailor, asylum-attendant, tanner.	

Degree of Dependence on Holding. With all the 85 dairying smallholders the holding was the chief source of employment and of income, but 25 of the smallholders stated that they had some supplementary employment. Only 49 (or 60 per cent.) of the horticultural smallholders were entirely occupied on their holdings; of the remainder, 18 worked most of the time on the holdings and 14 regarded their holdings as supplementary to some other main occupation. With two exceptions all the 21 poultry smallholders were fully occupied on their holdings, although 10 were in receipt of pensions or had private sources of income. In the group of 28 miscellaneous holdings, three smallholders regarded their holdings as of secondary importance, and a further 13 had some supplementary occupation or source of income. The other occupations of the 85 smallholders not entirely dependent on their holdings, were as follows :—

31 pensions or private income.	3 fruit salesmen.
13 farm-workers.	2 thatching.
11 haulage.	2 shopkeepers.
4 gardeners and nursery workers.	2 builders' labourers.
3 keeping visitors.	2 coal merchants.
	2 engineers.
1 each, selling feeding stuffs, wife working out, newsagent, bricklayer, carpenter, huckster, water-bailiff, asylum attendant, fish-monger, cattle-dealer.	

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It was found that 57 of the dairy smallholders were members of the National Farmers' Union, 15 were also members of a farmers' co-operative society, two members of a milk recording society and one a member of the Producer Retailers' Association. Among the 81 horticultural smallholders there were 6 members of a smallholders' association, 14 members of a fruit-growers' association, 2 members of a co-operative purchasing society, and 1 member of a glass-house growers' association. Of the 21 poultry smallholders 3 had received technical training in poultry keeping, 6 were members of the Scientific Poultry Breeders' Association, 1 was a member of the National Farmers' Union, and 1 a member of a co-operative purchase society. The 28 miscellaneous smallholders included 8 members of the National Farmers' Union, and 1 member of the Scientific Poultry Breeders' Association.

Numbers Employed. All the smallholdings are, of course, predominantly family undertakings in the sense that the members of the family do the bulk of the manual labour. There was considerable variation in the concentration of employment on the various types of holdings, and in order to show this, the position in each type group will be given in turn.

The total number of persons, family and hired, employed on the 85 dairy-holdings was 250, which is equivalent to 2.9 persons per holding or 42 persons per 1,000 acres. On 30 holdings there was no hired labour at all, while on a further 21 holdings only a very small amount of hired casual labour was employed. On 51 holdings (60 per cent. of the total), therefore, practically all the labour was family labour. Of the other holdings 15 employed one hired man regularly, three employed one man and some casual labour, five employed one man and one boy, three employed two men, two employed three men, and one employed three men and one boy.

For these dairying holdings information is also available concerning the size of the family and the numbers of children of working age who had remained to work on their parents' holdings and the numbers who had sought work elsewhere. On 20 holdings there were no children, on 24 holdings there were children of school age only, and on 41 holdings there were children of working age. The total number of children

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on these 65 holdings was 149, of whom 96 (52 sons and 44 daughters) were of working age. Of the sons, 27 had remained on their parents' holdings; 6 while doing other full-time work, assisted on the holdings in their spare time; the majority of the remaining 19 had taken up non-rural occupations away from home. Of the 44 daughters, 17 had remained on the holdings, while 27 had either found other employment or were married.

The total labour force on the 81 horticultural holdings was 185, which equals 2.3 persons per holding or 260 persons per 1,000 acres—a very much higher concentration of employment than on the dairying-holdings. Nearly 73 per cent. of the holdings were practically dependent on the family for the supply of labour. On 32 holdings no labour outside the family was employed, while on a further 27 holdings a little seasonal labour was employed in addition to that performed by the family. Of the holdings employing hired labour, eleven employed one man regularly, seven employed two hired men, one employed three hired men, one employed four hired men, one employed one man and one boy, and one holding employed one boy. Unfortunately, it was not possible to obtain much information about the size of families on these holdings.

The 21 poultry holdings gave employment to 45 persons which equals 2.1 persons per holding or 30 per 1,000 acres. On 14 holdings family labour alone was employed. Of the other 7 holdings one employed one hired man, one employed one man and one boy, one employed one man and two boys, three employed one boy, and one employed three boys. On 8 of the holdings there were no children. The total number of children on the other 13 holdings was 24, of whom 5 were of school age and 19 (11 sons and 8 daughters) were of working age. Of the 11 sons, 2 had remained on their parents' holdings, 2 had other full time work, but rendered some spare time assistance, 1 was a poultry-farm manager, and 6 were employed in non-rural occupations away from home. Of the 8 daughters 6 had remained on the holdings.

The information on employment on the 28 miscellaneous holdings is not so complete as that already given. On all the holdings the family supplied the bulk of the labour, 18 holdings employing no hired labour, nine employing regular hired workers, and one employing casual labour only.

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General Layout and Equipment. The 85 dairy-holdings were isolated holdings in the sense that they were not grouped together, although in several instances two or more holdings were fairly close together, having been carved out from a previously-existing large farm. There was considerable variation in the general layout; on 46 holdings the land was practically within a ring fence and the fields reasonably arranged, but on the other 39 holdings the fields were scattered and their lay-out was inconvenient. There was also considerable variation in the buildings; on 14 holdings the buildings were ample and in very good condition, 38 holdings had good and adequate buildings, but on 33 holdings the buildings were poor and inadequate for the proper conduct of the holdings. The average distance of all holdings from a railway station was 4 miles and from market 6·5 miles. The means of transport used were as follows: 42 holdings relied entirely on horses, 30 hired motor-vehicles when necessary and 13 possessed their own motor-vehicles. Only 5 holdings were on the telephone, while 63 holdings had wireless sets. Only 9 holdings were equipped with electric-light, 2 used gas, and the remaining 74 holdings using oil lamps for lighting.

The horticultural holdings differ in many ways from the dairy holdings in their general lay-out and equipment. They are much more closely grouped together, being more or less in small colonies. Again, the houses do not form an essential part of the holdings in the same way as they do on the dairy holdings. In most instances the houses could be described as town or suburban dwellings, and in only 50 per cent. of the holdings was the land attached to the house. The land itself was, also, in most instances divided into two or more separate plots. These holdings differ further from the dairy-holdings in that they need very little by way of out-buildings for their conduct. In a way, they have the appearance of large allotments, with a roughly constructed shed for keeping the necessary implements and a few machines. Most of the holdings had fairly ready access to a roadway. The average distance from a railway station was 1·8 miles and from market 5 miles. For the transport of produce 24 small-holders depended on hiring, 29 had their own horses and vehicles, and 28 had their own motor-vehicles. Only 6 holdings were on the telephone, but the majority possessed wireless sets. Proximity to the towns accounts for the fact

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that 28 of the smallholders' houses had electric-light and 12 had a gas supply.

All the 21 poultry-holdings were within a ring-fence, although two of the houses were some distance from the holdings. No holding was over 8 miles distant from either a railway station or a market. For purposes of transport 2 holdings had their own horses and horse-vehicles, 8 had motor-vehicles and 11 hired transport when required. Only 3 holdings were on the telephone, while 15 had wireless sets. Electric-light was installed on 4 holdings, 1 used gas, the remaining 16 holdings using oil lamps for lighting.

The 28 miscellaneous holdings presented a variety of layout and equipment. Their average distance from a railway station was 3 miles and from market 5 miles. For transport, 4 holdings used their own horse-vehicles, 9 had motor-vehicles of their own, and 15 hired transport when needed. Only 2 were telephone subscribers, but 19 possessed wireless-sets. Electric-light was installed on 1 holding only, and 2 used gas.

(To be continued.)

BREAKING UP GRASS LAND

A. W. OLDERSHAW, B.Sc.,

Agricultural Organizer for East Suffolk.

THE condition of our grass land cannot be regarded with any degree of satisfaction. Sir Thomas Middleton places the production of ordinary pasture at no more than 90-100 lb. of lean meat per acre per annum, and he considers, if both quality and quantity are taken into account, that the best pastures produce quite three times as much as the average and are ten or twelve times as productive as the poorest. He considers that the nation does not derive more than 72 lb. of meat or 133 gal. of milk per acre per annum from her grass lands.

Much further valuable information on this subject will be found in Professor R. G. Stapledon's book, "The Land, Now and To-morrow."

Sir Thomas Middleton places the relative productivity of arable and grass land as follows: --

						<i>Number of Persons supplied with a subsistence diet for one year</i>
100 acres	very poor	grass converted into meat	..	..	..	2
100	"	medium	"	"	"	12-14
100	"	very good	"	"	"	25-40
100	"	mangolds (average crop)	"	"	"	35
100	"	wheat (average)	"	"	bread	200
100	"	potatoes (average) as vegetable	"	"	"	400

There is evidence from Saxmundham Experimental Station* that weedy grass land, broken up, put through a course of tillage and then re-seeded with a modern grass mixture, becomes very much more productive of grass, which is also of better quality.

Grass land may be broken up with the object:

(1) Of re-seeding it with better mixtures in order to increase its productivity as grass; or

(2) Of increasing the food supply of the country by increasing the tillage area; or

(3) Of increasing the profit to the individual farmer by growing valuable arable or fruit crops; or

* OLDERSHAW, A. W.: Thirty Years' Grass Land Experiments at Saxmundham, *Jour. R.A.S.E.*, Vol. 95.

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(4) Of tapping the fertility of the soil accumulated during a period in grass; or

(5) Of turning into arable, land which in the opinion of the occupier is better suited for that purpose; and for various other reasons.

In view of the interest taken in the subject at the present time it seems desirable to examine briefly the question of breaking up grass land, in order to see how it may best be done in order as far as possible to avoid the many crop failures that are apt to occur.

Lord Ernle, in his book "The Land and Its People," gives the following figures regarding land broken up from grass during the War. It appears that out of 1,400,000 acres of broken pasture, throughout the country, 250,000 acres were cropped with wheat, which, including total or partial failures, gave an average crop of 31.3 bus. per acre. Oats were sown on 850,000 acres of broken grass, and gave an average crop of 43.7 bus., some crops being very good and some very bad. Barley was grown on 75,000 acres, and gave the not very high average of 28.8 bus. Potatoes, on 32,000 acres, gave the very useful average of 7.1 tons; beans, on 14,000 acres, averaged 27.5 bus.; and peas, on 15,000 acres, gave 26.9 bus. These figures are taken from returns furnished by the Agricultural Executive Committees and represent average figures from the whole country and from very varying conditions.

The writer has made notes of the methods adopted, and the results obtained, in a considerable number of instances in which pasture was broken up during, and since the War, these observations extending over a period of about eighteen years. There seems to be very little doubt that the methods likely to be successful depend to a great extent upon the type of soil and the local climate. In spite of this, however, it is possible to arrive at certain general conclusions, according to the type of grass land involved.

(1) Grass Land consisting largely of Weeds and Inferior Herbage. There is in this country a very large area of so-called "grass" that has never been properly seeded down, and that, for various reasons, consists largely of weeds and inferior herbage. Where these weeds are such as are likely to persist in the arable land, as they frequently are even when they are thoroughly buried, there can be very little doubt that it is best, in most instances, to give the land a thorough fallow before cropping. If this is not done, the

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land will have to be fallowed in a year or two, so one might as well make a good start, with clean land. The land may be broken up by mechanical or horse power, as soon as it is fairly dry in spring, and a whole summer fallow given, or the first flush of the grass may be utilized, and it may be broken in late June or early July, and a late summer fallow given.

(2) Land covered with a Mat of Undecayed Vegetable Matter. This is very likely to be poor in lime, and the opinion of a soil chemist should be obtained as to this. After breaking up, satisfactory crops of oats and potatoes may be obtained without lime, but many of the other farm crops are likely to fail. As the action of lime is apt to be slow, any application necessary would be best given as soon as possible after ploughing.

A convenient way of breaking up land that has a mat of vegetable matter on the surface is to use two ploughs, one following the other. The first plough goes to a depth of only 2 or 3 in., and throws the turf to the bottom of the furrow. This is followed by a second plough, which thoroughly buries the turf. In one instance, a tractor was used to draw the second plough, and the wheel of the tractor wedged the surface material deeply down, so ensuring the thorough consolidation that is so important in breaking up grass land.

Even when there is no surface mat, the method of having two ploughs, one following the other, the first one throwing the turf to the bottom of the furrow, has much to commend it. It ensures that practically all grass is buried, and in consequence this does not come up in the following crop. By the time the first crop is removed, the grass has thoroughly rotted.

This method of double-ploughing can only be used where there is a good depth of soil, as a rule it is unwise to bring any considerable quantity of subsoil to the surface.

(3) Ordinary Grass Land, practically free from such perennial weeds as are likely to come up in arable land, and also free from a surface mat, may be ploughed in the ordinary way in late autumn or winter. If a skim coulter is used so that all the pasture grass is thoroughly buried, there should be no trouble the following season from this grass appearing in the crop.

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The thorough consolidation that is so important may be obtained by a furrow press following the plough, or on small areas by the wheel of a cart following the plough down each furrow, or by repeated rolling with a heavy roller.

It is probable that failure to obtain sufficient consolidation, and the insect attacks commonly associated with it, are responsible for more failures after breaking up grass land than any other single cause; hence for some crops it is quite worth while to spend as much labour on consolidating the land as on ploughing it.

Subsequent Treatment of Ploughed-up Grass Land.

Where grass land has been down for a long period, there is usually a large accumulation of vegetable matter that renders the land "light" and spongy in texture for a number of years. This condition, whilst good for certain crops, such as potatoes, is not at all suitable for others, such as cereals, hence special care must be taken for a number of years after breaking up, to secure sufficient consolidation.

Condition of Fertility of the Broken-up Land. The success or failure of subsequent crops depends very largely upon careful consideration being given the question of fertility. Good, or even average grass land when broken up often contains a very considerable store of fertility, especially of nitrogen. Sometimes this may be so great that for a number of years all corn crops are very apt to be laid flat, and, in consequence, to be to a great extent ruined. In such circumstances, it would be wise to grow crops such as cabbages, kale, mangolds, and sugar-beet, which can profitably utilize a large supply of nitrogen. Although there may be an excess of nitrogen present, there is very likely to be too small a store of available phosphates, lime, and potash, especially of the two former.

On good land, the first few crops grown may very likely require very little nitrogenous manure or farmyard manure, but may be very responsive to mineral manures. Poor grass land, on the other hand, may contain very little available plant food, especially in the first year after breaking. In subsequent years, the vegetable matter tends to decay and become available. In the first year, a little readily-available nitrogen, phosphates and potash may make all the difference between a crop and no crop. Readily-available manure also

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often greatly helps the crop in surviving the attack of soil insects.

Thus poor grass land in a high-lying or late district, ploughed up and put in with oats, would be very likely to give a greatly increased crop if, before the oats were sown, a dressing of, say, 1 cwt. of sulphate of ammonia, 3 cwt. super-phosphate, and 2 cwt. of kainit were applied. The crop would also be likely to ripen earlier. This earlier ripening of crops suitably manured has been observed in a very striking manner in mountainous districts where the harvest is often very late.

Crops after Broken-up Grass Land. Brief consideration of a few of the commoner farm crops, with reference to their suitability for growing on broken-up grass land, may be useful here.

Oats. As previously mentioned, a large proportion of the grass land broken up during the War was planted with oats. On medium and light types of soils under most of the climatic conditions prevailing in the British Isles, oats are a very suitable crop, especially if the land is inclined to be acid. In the drier parts of England, they are less likely to succeed than in the cooler and moister parts. On rather heavy soils, in a comparatively dry climate, such as prevails in eastern England, they are very risky and apt to fail. Where the land is inclined to be rich in nitrogen, a stiff-strawed variety should be chosen, or the crop may be badly laid.

When spring oats follow grass, the land has usually been ploughed up during the winter. In this ploughing, a skim coulter should be used, and great care should be taken to bury all the grass, so that it will not come up again. Thorough consolidation in spring is desirable. As previously mentioned, on poor land, and very often in high-lying districts, the chance of the crop being a success will be greatly increased if a suitable mixture of chemical fertilizers is given.

Wheat. As previously noted, during the War a quarter of a million acres of grass land were planted with wheat and the average yield was a very fair one. Still it must be recognized that wheat is rather risky as a first crop after grass.

On land broken up during the summer it is subject to attack by wire-worms, the wheat bulb fly, and other pests. It is usually a difficult task to get such land solid enough for

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wheat in the autumn, but the land press is a great help. Where land is ploughed in late autumn, and sown with wheat almost at once, the chief point again seems to be to get the land solid. This may be done by means of the land press, or by repeated rollings. Although land broken up from grass may contain an abundance of plant food, this may not be easily available. A small dressing, say 3 cwt., of superphosphate per acre, applied before sowing the wheat, will almost always help rapid and abundant root-formation, and hence help the plant to withstand insect attack. In early spring, an opinion may be formed as to whether the wheat needs nitrogenous manure. On quite a proportion of land growth may be too rank, and the crop in danger of becoming laid. If so, it may be desirable to run the sheep rapidly over it, in order to eat off the rank growth and consolidate the soil around the roots. The crop should not be eaten down closely. With crops of this kind, nitrogenous manure would do harm. On the other hand, there are almost certain to be instances in which the wheat looks starved, yellow and poverty-stricken, and in which a small dressing of nitrogenous fertilizer may very likely greatly improve the crop.

The choice of variety is rather important. A good tillering kind should be chosen. On poor land, Little Joss is suitable. It has a great power of filling up in spring if it has been thinned out by insect attack. On good land, Yeoman tillers well and stands up reasonably well. On really rich land, Holdfast is probably suitable. For medium conditions, Wilhelmina is a safe kind to grow, and probably also Juliana. Squarehead's Master is suited for land that is not very rich. On good land, this variety is apt to get badly laid.

Barley. On the whole, barley is probably the least suitable of the three commoner cereals to grow after broken-up grass. Still, there is no reason why it should not be tried (especially on the lighter loams containing plenty of lime) where circumstances have prevented the drilling of other crops. As is well known, barley can be drilled later in spring than other cereals, with a fair prospect of success.

Rye. There are very few records of instances in which rye has been put in after broken-up grass. In times of food shortage, rye is of very great value, since it will grow good crops of both grain and straw on land that is so light and poor in lime that it will not grow the other cereals satisfactorily.

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Sandy heath-like land, if ploughed deeply, and in such a way that all the surface vegetation is buried, is very likely to give an excellent crop of rye as the first crop, especially if it receives a good dressing of nitrogenous manure. Rye, if adequately manured, gives quite good yields of grain. Thus, at Tunstall Experimental Station, Suffolk, on light sandy land, yields up to 48 bus. per acre have been obtained regularly over a period of years.

Grass. A considerable measure of success in Wales and Derbyshire has been obtained on poor grass land by simply ploughing up and burying the old turf, applying lime and phosphates where necessary, and re-seeding almost at once with a modern grass mixture containing wild white clover. Sometimes a few pounds of rape per acre have been used as a cover crop. This is fed off with sheep and the treading helps to consolidate the land. The result of this treatment has been a vastly improved herbage. The difficulty that exists on so many inferior pastures, of a mat of undecayed material on the surface, is got over by burying it. The small seedling clovers and grasses find the lime and phosphates on the surface and can immediately utilize them. In certain circumstances, it is probable that it is worth while adopting this proceeding even if the new pasture is only left down a few years, and then broken up again.

After a few years of temporary grass, with a sufficient supply of lime and phosphates present, the land will be in a much better condition to give satisfactory arable crops, when finally brought under the plough. Moreover, the original mat of undecayed vegetable matter will be largely decayed.

This plan is likely to be most successful when one breaks up a pasture consisting largely of inferior plants that are likely to die when thoroughly buried. Certain grass-land weeds (e.g., buttercup and fleabane) do not seem to be injured by being buried. If they are present, they will reappear in the new pasture and be as troublesome as formerly.

Professor R. G. Stapledon has stated* that by re-seeding and manuring, poor upland pastures now produced over five times as much edible dry matter as was obtained from pastures not so treated. Lowland fields, giving live-weight increases of no more than 120-200 lb. per acre, had, after proper manuring and re-seeding, given live-weight increases up to and exceeding 700 lb. per acre. Re-seeding was more

* Paper read before the Royal Society of Arts, May 13, 1936.

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important than anything else. Heavy liming and heavy phosphating were the first necessity in many districts. Both gave maximum value when pastures were broken and re-seeded.

Again, Professor Stapledon states* that, "By ploughing up and re-seeding (always with leafy perennial ryegrass and wild white clover) accompanied by generous phosphating, poor fescue pastures standing at elevations up to 700 ft. can be converted into really good rye-grass pastures."

On the upland pastures of Derbyshire, Mr. J. R. Bond and his colleagues have been working at the problem of ploughing up and re-seeding pastures for the past 18 years. During the summer of 1936, Mr. Wells, assistant Agricultural Organizer for North-West Derbyshire, showed the writer certain high-lying pastures on which, by ploughing up and re-seeding at once, after an application of lime and phosphates, very great improvements in both quality and quantity of the herbage had been effected. The improvement was so great that the resulting pasture was undoubtedly worth three or four times as much per acre as the original.

Flax (Linseed). The flax plant, either for seed or fibre, is apparently a very safe one to grow as a first or second crop after breaking up grass land, as it suffers very little from attack by soil insects. The grass land would usually be ploughed (using a skim coulter to bury all grass) in winter, and the seed sown not too early in spring, a fine tilth being very desirable. When grown for seed, the crop may be cut with the binder. When grown for fibre, the crop is pulled in the usual way.

Grass and clover seeds may quite well be sown in flax, so that, if desired, the land could be sown down again to grass, using linseed as a nurse crop.

Peas. On most classes of land in a dry climate, field peas have been observed to succeed well on broken-up grass. The land is ploughed in autumn or winter, all grass being thoroughly buried. The variety of peas chosen should be a vigorous one with a fair amount of straw. A short-strawed variety is apt to encourage the growth of weeds. For moderate and poor land, Black-eyed Susan, Norfolk Dun, Maple, or Prussian Blue will be found suitable. On good land, Harrison's Glory blue peas will be likely to succeed. In some instances the more delicate table varieties of peas have given quite good results.

"The Land, Now and To-morrow," p. 165.

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Peas will not succeed unless the land contains sufficient lime and is efficiently drained. A small dressing of fertilizer—say, 2 to 3 cwt. of superphosphate with $\frac{1}{2}$ cwt. muriate of potash per acre—will usually reduce the chance of crop failure.

Beans. On average or somewhat poor heavy land, and in a dry climate, few crops have been observed to thrive better than field beans, after broken-up grass. Winter beans may be put in after a summer fallow, to kill the weeds in the grass; or the grass land may be ploughed in September and drilled with beans in October, or ploughed in winter and drilled with spring beans. A skim coulter should be used to bury all the grass thoroughly.

As a rule, a dressing of phosphates with a little potash will greatly help the beans. Farmyard manure will also be suitable for use on the poorer classes of land, but on better land, it might cause the beans to become too "rank" and to have too large a proportion of straw to corn. If beans are grown on really good grass land broken up, they are very apt to grow too much straw and very little corn.

A mixture of 2 bus. spring beans and $\frac{3}{4}$ bus. maple peas has been found successful on rather poor heavy land, the mixed crop being cut with the binder.

Vetches, and Silage Mixtures containing Vetches, are very suitable for broken-up grass land on second-class soils, provided sufficient lime is present. Probably few crops are less likely to fail, even on rather poor land. If the crop is folded with sheep or made into silage or hay, the land can be broken up in July and a half-fallow given to it.

Potatoes. On the lighter types of soil and where the land is fairly good, potatoes are an excellent crop to take on broken-up grass land. Perhaps the most serious danger is that they may be attacked and penetrated by wireworms, in this way being rendered less saleable.

Potatoes may very well follow grass land broken up and fallowed the previous summer, and this is a very good preparation for them. Alternatively, the land may be double-ploughed in winter, the first plough turning in the grass and weeds, and the second covering them up.

Potatoes on broken-up grass require adequate manuring—farmyard manure may very well be applied where possible. The quantity of artificial manure would depend upon whether farmyard manure had been used and upon the "rankness"

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of the land. On rank land, rich in nitrogen, the amount of nitrogenous manure must be strictly limited. On the other hand, on such land the amount of readily available phosphates and potash may be small, and a good dressing of manures containing those plant foods may be very desirable. On average or rather poor land, all three plant foods will usually be required in average proportions.

Potatoes are likely to succeed even if the land broken up is slightly acid and lacking in lime. They usually thrive extremely well on newly broken-up grass for some years after breaking. They appreciate the sponge-like texture of the soil, due to the partially-decayed roots of the grass. Sandy "grass" land adjoining or resembling a heath, planted with potatoes (adequately manured) as a second crop after breaking up, has often yielded well.

Mangolds and Sugar-beet. Both these crops have given good results when comparatively rich land has been broken up from grass. They are well able to utilize the excess of nitrogen present in all but the very richest of land. In preparing the land, probably the best proceeding is to double-plough in late autumn, throwing the turf to the bottom of the furrow. In the spring, the land is worked on the surface (without bringing the grass to the top) and very thoroughly consolidated before drilling. The importance of consolidation cannot be over-estimated.

As a general rule, it will be desirable to apply phosphates and potash to the crop, also a dressing of nitrogenous manure depending upon the known fertility of the land. On the poorer types of land, 2 cwt. of nitrogenous manure might be applied at the time of sowing. On really rich land, $\frac{1}{2}$ to 1 cwt. per acre—to give the small plants a start—may be all that is necessary. The readily-available plant food in the manure undoubtedly helps the plants to grow away from soil pests.

There are several records that show that naturally rich land, though producing very poor quality grass, most unpalatable to stock, produced most excellent crops of sugar-beet, both as a first crop after ploughing up, and subsequently.

Cabbages, Kale, and their allies—members of the Brassica family. Probably few crops are better suited for planting on really rich broken-up grass land than are cabbages and their allies. These can utilize, perhaps better than any other farm crops, the excessive amount of nitrogen present under such

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conditions. Moreover, their tough stems enable them to resist the attacks of wireworms, leather jackets, and similar pests that are so frequently troublesome on broken-up grass land.

These plants, however, are sensitive to soil acidity, and will not thrive unless there is a sufficient supply of lime in the soil.

Swedes and Turnips. These have not been very frequently grown as a first crop on broken-up grass. On land broken up in late spring, there is no reason why they should not be grown. As a rule, a dressing of superphosphate would help the plant very much in the early stages of growth.

Rape has been found very suitable as a nurse crop where the land has been immediately sown down again to grass. Rape is undoubtedly a very suitable crop to grow, after grass, where sufficient lime is present, especially where the land is likely to be too rank for corn. It is also suitable for high elevations where the climatic conditions are not suited for corn.

Maize. Although very little information on the subject is available, it seems probable that small areas of rather rich soil, under grass—possibly over-manured, owing to proximity to the homestead—might be very suitable for cropping with maize in the southern parts of England where the crop succeeds. Double ploughing would probably be desirable.

Mustard. Black mustard, grown for seed, may be a very suitable crop for growing on the richer types of grass land, when broken up. White mustard, either for seed, for sheep folding, or for green manuring, may be quite suitable for most land except the very lightest.

Lupins. For sandy heathland, poor in lime, broken-up late in spring, lupins are a very suitable crop. Blue lupins may be saved for seed, or folded with sheep (with certain precautions, owing to the poisonous nature of the crop), or ploughed in as green manure. On land of this type, they are an excellent preparation for rye.

Black Currants require a considerable amount of nitrogen in the soil. They have been found to succeed very well on broken-up grass land of good average quality.

EIGHTEENTH-CENTURY CROP HUSBANDRY IN EAST ANGLIA (NORFOLK, SUFFOLK, AND ESSEX)

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THE famous Norfolk four-course rotation is the outstanding achievement of the eighteenth century arable farming. This course of turnips, barley, clover, and wheat¹* became the standard of good husbandry in Norfolk and East Anglia generally, although there were many variations from it in all the cultivated parts of the district. It is doubtful, however, if the invention of this rotation can be attributed to the eighteenth century. It was certainly worked out in the seventeenth, and its first introduction followed the close of the Civil War.² This four-course system is, indeed, still the basis of arable farming throughout most parts of the country.³ There is no doubt that its extension to a very widely distributed area of the country was in a large measure due to the propagandists of the eighteenth century.

Turnips were cultivated as cattle food in Suffolk before they were in Norfolk.⁴ In Suffolk also in the early part of the century the less fertile arable was manured with chalk, rubbish, clay, and a then lately discovered "Cragg" or shell marl, and in 1735 it was said to be due to this that many hundreds of acres had been made to yield larger crops.⁵ This improvement took place in the first thirty years of the eighteenth century, because the county was not favourably regarded by a traveller in 1707, except for grazing, while he reports that much of Norfolk was fruitful in wheat and sheep, the latter being folded on the arable.⁶ Carrots, afterwards so much written about by Young and others, were also cultivated for feeding cattle in these two counties, as early as 1739.⁷

These counties are freely commented upon by William Ellis, particularly with regard to the crops grown on the light soils. The main crop, he says in one place, is barley for malt or feeding poultry or hogs, and turnips are grown in the common fields, while white oats may be sown on the light lands of both these counties and in Kent during April, if the land has been well dunged. Marling was also done on the gravels and sands of newly-broken grass. He had seen

* For these references see p. 40.



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It says, "I, "

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These pictures of the Norfolk and Suffolk ploughs were published in William Pearce's *General View of the Agriculture of Berkshire* 1844 to encourage the Berkshire farmers to use these ploughs in place of the much heavier and less efficient plough common in that county.

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French wheat (buckwheat) ploughed in for green manure in Norfolk and thetches, after the head was eaten off, were also ploughed in, but rye is said to be the saviour of the Norfolk and Suffolk farmers on their sandy soils. Adaptations of the four-course system to suit varieties of soil are mentioned. There is, moreover, no doubt in his mind that more turnips are grown in these counties than elsewhere, and that hoeing is very important.⁸ A method of holding the sand down after sowing hay seed, which sounds curious, was to lay furze bushes on the land and enclose it by a white thorn hedge. After a sward was obtained the land was ploughed for turnips and carrots.⁹ From this date onwards we hear more and more about the use of carrots as fodder; they were thought by Young to be a good fallow for barley, while parsnips and parsley are also reckoned good forage.¹⁰

It is interesting to note that in 1759 the Norfolk farmers were producing so much grain in excess of their own requirements that they petitioned to be allowed to export the surplus on the grounds that their farms were mostly arable.¹¹ Young's *Tours* afford us a great deal of detailed information about the cultivation of the districts through which he travelled, but the detail is so complete that it is not possible to cite it *in extenso* here, nor indeed is that necessary. By the very constitution of his mind he was more inclined to supply information regarding experiments and innovation and only to condemn those who carried on in the way of their fathers; we must, therefore, assess his remarks carefully and be warned against taking the comparatively isolated marvels he relates as being indicative of a general state of agriculture. Even Lord Ernle admits that, in spite of the astonishing rate of progress made by farming in the eighteenth century, population before 1760 grew so slowly that the soil, without any very great increase in farming skill, or in cultivated area, produced a surplus, and, again, that it would probably be true to say that the country as a whole had made no general advance on the agriculture of the thirteenth century, a somewhat strong statement.¹²

Much emphasis has deservedly been laid upon the work done by Coke in this district, and this work was the more creditable because he did not, as is so often stated, settle down in the midst of a waste, but in a highly cultivated county, where it was difficult to introduce new crops because the husbandry was famous.¹³ Young, moreover, holds the

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opinion that Townshend introduced the turnip to Norfolk (? from Suffolk), but that the idea that he was the first who marled there is probably erroneous.¹⁴ Marling was, of course, one of the measures adopted in reclaiming the light lands, and was often done very heavily, one farmer in Suffolk putting on as much as eighty loads an acre, each load containing about thirty-six or forty bushels.¹⁵ Oil cake was also imported from Holland, broken up and used for manure, as well as for feeding purposes, but it is doubtful if this practice was really widespread.¹⁶ Marshall estimates the arable area of Norfolk at 600,000 acres, divided into 100,000 acres of wheat, 200,000 acres of barley, 100,000 acres of clover, and from 50/100,000 acres of clover seeded annually,¹⁷ and Kent reports two-thirds of the county under arable cultivation in 1794.¹⁸ Young, who reports on Suffolk, is naturally more definite about the area of waste than anything else, and estimates it as 100,000 acres.¹⁹

As Young says, in making a comparison between the farming of these two counties and Kent, the soil of Suffolk was good and the farming was more elaborate and productive, but in Norfolk it was more a work of art. One of the necessities of farming, which is a work of art, is to possess good and efficient implements. Consequently we find constant praise of the Norfolk and Suffolk ploughs, the former a wheel-plough and the latter a swing plough of light build (see illustrations). Even in the early part of the century the Suffolk plough was used with a single horse, with good results,²⁰ but the more usual practice was to use two horses and have one man to drive and guide, thus ensuring economy of working. Similar light ploughs were used to advantage in some parts of Essex.²¹ The Suffolk swing was improved by a "very ingenious" blacksmith named Brand, and it was built of iron, some time before Young reported on the county.²² With such light implements it was, of course, common to plough shallow.²³

Young states that the drill roller invented in Norfolk was gaining ground in Suffolk, but there was some disagreement about this implement, because Marshall states that drilling was not done in Norfolk, although there was some drilling of wheat and peas with a dibbling roller,²⁴ while Young says that Cooke's drill was generally used in Norfolk.²⁵ Trench ploughing was also practised in these counties, as it also was on similar soil in some of the northern counties.²⁶ It may be

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that, apart from their geographical position, accessible by sea to Holland and to the great mart of London, the security of tenure in Norfolk, where leases of 21 years were common, and the large number of yeomen in Suffolk, have some bearing upon the development of improved agriculture in these counties; there was, moreover, the tendency for wheat cultivation to betake itself to lighter soils, as well as the fine examples of a few improving landlords.²⁷

Essex in the eighteenth century was a county with a great proportion of small estates;²⁸ like Norfolk and Suffolk it had a large woollen manufacture. While the marshes of the Thames Valley and near London were largely employed in grazing for the supply of London, there was much arable land in the county, and the characteristic improvements were hollow draining, and manuring with chalk brought from the pits on the Kentish coast.²⁹ Other manures were a mixture of horse dung and lime for barley, which was also used in Hertfordshire for the same crop,³⁰ while oil cake was used not only here, but in the reputedly badly cultivated county of Cambridge, at the rate of 6,000 per acre.³¹ In spite of the inclosed character of the county, however, Bradley states that in his day (1727) the three-field system, i.e., wheat, barley, or oats, fallow was prevalent both here and in the neighbouring county of Hertford, the wheat alone being looked to for profit, the summer grain, or etch crop, being disregarded in this respect,³² and there was no very great change by 1768, although by then some of the large farms were cultivated in a manner comparable to Norfolk.³³

There were, in addition to the ordinary crops of the arable land, special crops characteristic of Essex. Amongst these may be noticed teasels, grown for use in the cloth manufacture, hops and saffron,³⁴ after the last of which most contemporary topographers copying Camden (1610), state that barley could be grown for eighteen years without manure. Lucerne was also a crop that was early tried in this county as in Cambridge and a few other districts.³⁵ In Essex potatoes flourished at the end of the century, near Ilford, probably to a greater extent than in any southern county,³⁶ and when Young made his report the drill husbandry had become occasional.³⁷

Various different wheats were cultivated in the eighteenth century, but the writers tell us little of the distribution of the different sorts. In Essex it appears that "Eggshell" was grown on the lighter soil, and a double-eared or the Red

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Kentish or Poland wheat on the heavier, the latter also being used in Hertford. The statements made are not, however, uniform.³⁸ In Essex they dunged for oats, in order to make the land fit for wheat after, but in Hertford this was not done.³⁹ Buckwheat was also sometimes ploughed in for green manure as it was in Norfolk and Suffolk; apparently this was also done in Surrey and some other counties.⁴⁰ Apart from the ploughs that were similar to those of Norfolk and Suffolk, there were heavy draining ploughs and a type of mole plough in use by the end of the century, and some threshing machines had been established. The waggons were still as massive as they were in 1750, and when they called forth maledictions from Young in 1770, although one enterprising farmer had imported light carts from Edinburgh.⁴¹ By 1761 some attempt had been made to modify the mouldboard of the plough, for Mordant tells us it "is commonly made with an iron shield board bulging which turns the turf or earth better than any other sort of plough."

¹ Charles Varlo: *New System of Husbandry*, 1770, p. 123 ff.

H. Home: *The Gentleman Farmer*, 1776, p. 132.

T. Stone: *An Essay on Agriculture*, 1785, p. 25 ff.

² G. C. Broderick: *English Land and English Landlords*, 1881, pp. 46 and 47.

See also *Museum Rusticum*, IV (1764), p. 40 ff.

³ J. G. Stewart: *Pasture Making in the South East*, Jour. R.A.S.E., XC (1929), p. 81.

⁴ Defoe: *Tour*, 1724, I, p. 87.

Gentleman of the Inner Temple: *A Description of the Diocese of Norwich*, 1735, p. 9.

E. Bowen: *A Complete System of Geography*, 1747.

⁵ John Kirby: *The Suffolk Traveller* (who surveyed the county, 1732-34), p. 1.

See also Gentleman of the Inner Temple: *op. cit.*

Museum Rusticum, 1766, II, p. 132.

⁶ James Beeverell: *Les Delices de la Grande Bretagne*, 1707, I, pp. 86, 98.

⁷ Samuel Trowell: *New Treatise of Husbandry*, p. 21.

See also Robert Billing of Weasenham, Norfolk: *An Account of the Culture of Carrots*, 1765.

John Mills: *A Treatise on Cattle*, 1776, p. 304 ff.

⁸ *The Modern Husbandman*, 1750, I, p. 25; II, pp. 9, 29; III, pp. 66, 67; V, p. 93; Sept., pp. 33, 63; IV, pp. 30-31.

⁹ T. Hale: *Compleat Body of Husbandry*, 1756, p. 98.

¹⁰ John Mills: *A New System of Practical Husbandry*, 1767, III, pp. 165, 173, 181. (This book is, however, largely copied.)

Young: *The Farmer's Letters to the People of England*, 1767, p. 119 ff.

¹¹ G. Camborne: *An Enquiry into the Prices of Wheat, Malt . . .*, 1768, p. 94.

¹² *English Farming, Past and Present*, 1927, pp. 148, 195.

¹³ *Annals of Agriculture*, II (1784), pp. 353, 364.

¹⁴ *ibid.*, V (1786), p. 121.

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- ¹⁵ *ibid.*, II (1784), p. 117.
See also *Political Essays concerning the Present State of the British Empire*, 1772, p. 118.
(A. Young) : *Considerations on Agriculture*, 1780, p. 41.
T. Stone : *An Essay on Agriculture*, 1785, p. 1 ff.
Marshall : *Rural Economy of Norfolk*, 1787, I, p. 2.
- ¹⁶ Matthew Peters : *Winter Riches*, 1771, p. 97.
Marshall : *ibid.*, I, pp. 150, 216.
- ¹⁷ *ibid.*, I, p. 197.
- ¹⁸ *County Report*, p. 5.
- ¹⁹ *County Report*, p. 19.
- ²⁰ Gentleman of the Inner Temple : *op. cit.*, p. 3.
- ²¹ Matthew Peters : *Rational Farmer*, 2nd edition, 1771, p. 93.
Nathaniel Kent : *Hints to Gentlemen of Landed Property*, 1775, p. 92.
A Clergyman : *Useful and Practical Observations on Agriculture*, 1783, p. 32.
Marshall : *Rural Economy of Norfolk*, 1787, I, p. 139.
- ²² A. Young : *Suffolk*, 1797, p. 26.
- ²³ Cuthbert Clarke : *True Theory and Practice of Husbandry*, 1777, p. 50.
- ²⁴ Young : *ibid.*
Marshall : *ibid.*, p. 167.
See also T. Hale : *op. cit.*, p. 399.
- ²⁵ *County Report*, 1804, p. 58.
See also Thos. Stone : *op. cit.*, p. 142, and for a modern opinion, T. H. Marshall : *Jethro Tull and the New Husbandry*, *Econ. Hist. Rev.*, II (1929), p. 56.
- ²⁶ Chas. Varlo : *op. cit.*, p. 17 ff.
- ²⁷ A. Young : *Suffolk*, 1797, pp. 8, 13, 14, 24.
On the Size of Farms, Hunter's Geographical Essays, IV (1803), p. 570.
A. Young : *Norfolk*, 1804, pp. 26, 47.
H. C. Taylor : *Introduction to the Study of Agricultural Economics*, 1905, p. 290.
- ²⁸ H. C. Taylor : *Decline of Landowning Farmers in England*, 1904, p. 37.
See also Chas. Vancouver : *County Report*, 1795, p. 167.
A. Young : *ibid.*, 1807, pp. 58, 60.
- ²⁹ Ernle : 4th edition, p. 192.
See also Defoe : *Tour*, 1724, I, p. 8.
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John Mortimer : *Whole Art of Husbandry*, 1707, p. 60.
Edward Lisle : *Observations in Husbandry*, 2nd edition, 1757, p. 64 ff.
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W. Ellis : *Modern Husbandry*, 1750, May, p. 67.
A. Young : *Political Essays*, 1772, p. 128.
Nathaniel Kent : *op. cit.*, p. 76.
- ³⁰ Stephen Switzer : *Inconographia Rustica*, 1718, p. 171.
- ³¹ R. Bradley : *op. cit.*, p. 89.
- ³² *ibid.*, pp. 247, 284.
See A. Gentleman : *A New and Complete History of Essex*, 1770, I, p. 9.
- ³³ A. Young : *Six Weeks Tour*, 1768, pp. 59-70, 200 ff.
Eastern Tour, 1771, II, pp. 201-224.
See also Griggs : *County Report*, 1794, pp. 10, 16, and Young : *ibid.*, 1807, I, p. 201.
- ³⁴ John Mortimer : *op. cit.*, p. 121.
- ³⁵ R. Bradley : *The Country Gentleman and Farmer's Monthly Director*, 6th edition, March, p. 51.

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- ³⁶ Griggs : *County Report*, 1794, p. 14.
Young : *ibid.*, 1807, I, pp. 382, 390, and *Political Essays*, 1772, p. 148.
³⁷ *ibid.*, II, p. 73.
³⁸ John Laurence : *A New System of Agriculture*, 1726, p. 92.
John Mills : *op. cit.*, p. 71 ff.
³⁹ W. Ellis : *Modern Husbandry*, 1750, Feb., p. 80 ff.
⁴⁰ John Mordant : *The Complete Steward*, 1761, p. 25.
⁴¹ *ibid.*, pp. 275, 276.
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CUTWORMS AS SUGAR-BEET PESTS, AND THEIR CONTROL

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CUTWORMS* or Surface Caterpillars are the caterpillars of several different species of Noctuid moths. They often cause serious injury to a number of crops, e.g., sugar-beet, mangolds, turnips, swedes, potatoes, carrots, and Brassicas.

The caterpillars of the Turnip Moth (*Euxoa segetum*, Schiff.) and the Heart-and-Dart Moth (*E. exclamationis*, L.) are in this country the species that commonly cause damage to sugar-beet. Occasionally, in some districts, the most serious damage is caused by the caterpillars of another species, the Garden Dart Moth (*E. nigricans*, L.). The caterpillars of these three species are very similar. In colour they are a dirty grey, tinged with various shades of brown and sometimes green.

Observations on "*Euxoa segetum*." In several sugar-beet fields in 1935 this species was found to comprise practically the whole of the cutworm population. Damage and newly-hatched larvae were first found on June 29, and as daily examinations had previously been made, this date is very near that on which the first egg hatched. Within a week very small larvae, not exceeding $\frac{1}{2}$ in. in length, were found in several different localities. Subsequently they proved to be exceptionally widespread and were often present in very large numbers. Examination of lifted beet at various factories showed that cutworm injury was extremely common on beet grown in various types of soil. The caterpillars were much more numerous in July when they were young than later in the year. In some fields the later stages were

* These are often wrongly called Leather Jackets by the farmer. A Leather Jacket is the grub stage of a Crane Fly or Daddy-longlegs, and, unlike the cutworm, has no legs.

CUTWORMS AS SUGAR-BEET PESTS

common everywhere, whereas in others they occurred in definite patches.

The newly-hatched cutworms ate small round holes in the beet just below soil level. Larger holes and, later on, large cavities were made as the cutworms increased in size. The damage caused to larger beet was seldom of a serious nature, amounting only to a slight loss in weight. Late sown beet, not so far advanced at the time of attack, suffered more than beet sown early. Two fields in particular were badly attacked; the worst field had been drilled on May 13, and at the end of July the beet were still quite small. Cutworms were eating the roots at ground level, and killed many of the plants (Fig. 4). Often as many as six cutworms could be found at one beet. In September large and small bare patches could be seen in the field (Fig. 5) and the crop as a whole was very poor. The adjoining field, which probably contained as many cutworms, was drilled on April 15; here the beet were much bigger and although badly attacked were not killed.

Crops that were badly attacked soon after the first appearance of the cutworms, often grew rapidly and suffered little loss of plant. Fresh damage could still be found on attacked fields at lifting time. Fields of carrots and young brassicas were completely ruined by attacks of this cutworm.

In 1936 no damage to sugar-beet by newly-hatched cutworms of *E. segetum* was found in the field, nor later in the season, although moths were abundant in some districts. Large numbers of moths were collected at night in a field near Ramsey (Hunts.) on June 30 and July 3, when the following species were found:—

<i>Euxoa exclamatoris</i>	..	..	..	50 per cent.
„ <i>segetum</i>..	..	..	..	30 „ „
<i>Agrotis pronuba</i>	..	..	..	5 „ „
Other moths	..	..	..	15 „ „

It is of interest that we had not previously found cutworms of these species in sugar-beet fields in this neighbourhood. Only slight cutworm damage was found by examining large quantities of beet at the factories.

Observations on “*Euxoa nigricans*.” Cutworms of this species, which has not previously been regarded as a serious beet pest, caused severe damage to beet seedlings in the Fens, especially in the Ramsey (Hunts) district, in 1936. Similar

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damage had been recorded from this district in 1930 and 1935, and it is probable that the same species was responsible.

On May 14, 1936, Mr. O. S. Rose, of the Peterborough Beet-Sugar Factory, called our attention to the severe damage that cutworms were causing to sugar-beet near Ramsey. The infestation was then at its height, but the cutworms had probably been active for at least ten days. Sugar-beet seedlings were eaten off at ground level and by scraping away the soil the stumps were easily found. Larger plants were also attacked at ground level and cavities eaten into the side of the crown, several leaves often being cut through. Leaves cut off in this way and lying on the soil near the plants usually indicate the presence of cutworms.

A survey of 63 fields of sugar-beet in the Ramsey, Warboys, Chatteris area showed that 32 of these were badly attacked and for the most part would require re-drilling in order to obtain a satisfactory stand. A large percentage of the attacks occurred in fields that had grown potatoes in 1935. This crop commonly precedes sugar-beet in this district. Bad attacks were also seen where sugar-beet followed carrots or celery. Although cutworms were found in every beet field inspected in the Ramsey district, very little damage occurred where the beet followed corn, but in one field at Willingham, Cambs, where beet followed wheat, considerable damage was seen. By the middle of June the cutworms had disappeared. In the laboratory pupation commenced on June 13. Great difficulty was experienced in finding pupae in the field, but a few were eventually found.

About 100 caterpillars were brought back from this district and put into pots. From these pots 67 moths emerged from July 16 to the end of August. These all proved to be *E. nigricans*. Cutworms damaging young beet in other parts of the Eastern Counties proved to be *E. nigricans*, with one exception—two specimens of *Euxoa tritici*, L., being bred from cutworms obtained near Thetford. *E. nigricans* is said to occur most commonly in the Eastern Counties.

The above observations show that the damage to sugar-beet occurs in two distinct periods in the growing season; (1) to seedlings and young beet in May and June, by *E. nigricans*; (2) to older beet from the end of July up to lifting time, by *E. segetum*.

Damage during the early period has been found almost exclusively in the Ramsey district of the Fens and here it is

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caused by caterpillars of the species *E. nigricans*. We have no record of damage caused by these caterpillars later in the season.

Damage during the later period is caused by the caterpillars of *E. segetum* and possibly of *E. exclamatoris* (although the writers have never bred *E. exclamatoris* from caterpillars collected in sugar-beet fields) hatching from eggs during the growing season. We have no evidence of injury to seedlings by overwintered caterpillars of these species.

Control Measures Against "*Euxoa segetum*." Experiments were carried out at Snailwell, near Newmarket, to test the value of a poisoned bait in the control of *E. segetum*.

In this field cutworm damage was first noticed on June 29, and the small cutworms were found on June 30. On July 2, in addition to a large number of newly-hatched larvae, a few eggs were found in the soil, close to the young beet plants. On July 4, two plots each $\frac{1}{4}$ acre in area were baited with a mixture consisting of Paris Green $\frac{1}{3}$ d of a lb. and bran 10 lb. The Paris Green and bran were thoroughly mixed and then evenly moistened just sufficiently to enable the Paris Green to adhere to the particles of bran, but not to cause the mixture to become lumpy. On one plot the bait was broadcast by hand, rather more than 10 lb. being used on the $\frac{1}{4}$ acre. On the other $\frac{1}{4}$ -acre plot 10 lb. was more carefully distributed along the rows. On examining the plants on July 15 the following figures were obtained:—

				Cutworms, per 40 plants
Not baited	..	..	..	68
Bait broadcast..	..	..	..	24
Bait carefully applied	..	..	..	14

At a later examination (on July 22) the results were as follows:—

				Cutworms, per 40 plants
Not baited	..	..	..	21
Bait broadcast..	..	..	..	5
Bait carefully applied	..	..	..	0

At a still later examination (on September 23) the cutworms were full-grown and on the unbaited part of the field there was now about one cutworm to every three beet plants and fresh damage to the beets was observed. After a careful search no cutworms could be found in either of the baited plots, and there was no sign of fresh damage.

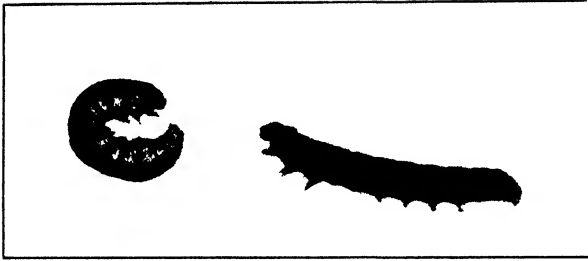


FIG. 1 Caterpillar of *Iuxoa nigricans*

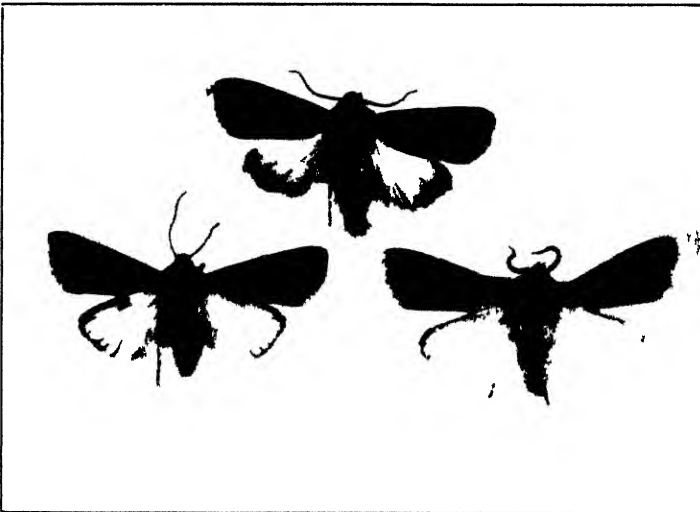


FIG. 2 Above *Iuxoa nigricans* Left *I. segutum* (Male)
Right *I. segutum* (Female)

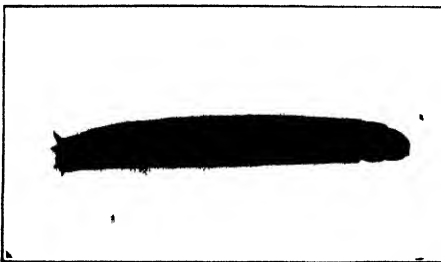


FIG. 3 Feather Jacket



FIG. 4 (Top) Injury caused by caterpillars of *P. segetum*
 Photograph taken July 30

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From this experiment it would appear that the caterpillars of *E. segetum* are readily controlled by means of a Paris Green bait at the rate of 40 lb. per acre early in July.

Control Measures Against "*Euxoa nigricans*." Experiments were carried out near Ramsey to test the effect of poison baits on the caterpillars of *E. nigricans*. These cutworms had eaten off nearly all the young beet plants in a field of 14 acres before the middle of May. On May 16 the grower prepared a Paris Green bait as described above. Immediately after the land had been prepared for a second drilling and the beet seed drilled, this bait was broadcast. Three days after baiting dead cutworms were found and a count of dead and living specimens at intervals yielded the following results on that part of the field which was baited at the rate of 40-50 lb. per acre.

No. of days after baiting	Caterpillars alive	Caterpillars dead
3	33	20
11	21	24
18	6	22

The final result shows that approximately 80 per cent. of the caterpillars had been killed.

On this part of the field the second drilling of beet at the rate of 17 lb. per acre produced a satisfactory plant. Owing to the limited supply of bait, part of the field received only 20-25 lb. of bait per acre. On this, the beet were subjected to a moderate attack of cutworms and large gaps were made in the rows. An adjoining field, in which the cutworms had ruined the first sowing, was re-drilled about the same time as the above field. This was not baited and here the plant from the second drilling was completely ruined by cutworms. Further evidence of the usefulness of the Paris Green and Bran bait was provided by another field which was baited on May 18 after re-drilling. Here the following counts were made on May 27:—

No. of days after baiting	Caterpillars alive	Caterpillars dead	Percentage killed
9	6	19	76

The living cutworms from these baited fields were brought back and after ten days in the laboratory (i.e., about three weeks after baiting) 16 out of 35, or about 45 per cent. died.

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On June 4, when many of the caterpillars were almost full-grown, the following bait mixtures were tried on small plots:—

A.	Paris Green	1 lb.
	Molassed pulp (dry)	20 lb.
B.	Sodium Fluoride	1 lb.
	Molassed pulp (dry)	20 lb.
C.	Sodium Fluoride	2 lb.
	Bran	20 lb.
	Treacle	1 lb.

The baits were all wetted before use.

The following results were obtained:—

Bait	No. of days after baiting	Caterpillars alive	Caterpillars dead	Percentage killed
A	5	5	21	81
B	5	12	11	48
C	5	2	9	82
Fate of living caterpillars (kept in laboratory) from the above counts:—				
A	14	2	3	60
B	14	4	8	66·6
C	14	1	1	50·0

From these experiments it appears that Paris Green makes a satisfactory bait whether used with bran or molassed pulp, but that sodium fluoride needs to be used at a higher concentration than Paris Green to give comparable results. Bran is probably a better medium for carrying a poison than molassed pulp, owing to its much greater bulk.

Handpicking. Some of the small-holders saved their beet by means of handpicking. This is not difficult as the cutworms are present just below the surface of the ground and easily found. On large areas this would be rather a slow method, but could be used to supplement baiting.

Conclusions. The trials indicate that the cutworms of *E. nigricans* can be reduced by means of poison baits and even when there is a severe infestation the second sowing of beet can be saved by timely baiting. No experiments were carried out on the first drillings as our attention was not called to this trouble until the crop was severely damaged. It is probable that the first drillings could be saved by baiting early enough.

It would appear that beet in the fen district between Ramsey, Peterborough and Chatteris is particularly subject to attacks from this caterpillar. Action should be taken by growers to prevent serious damage to the first drillings with its con-

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sequent loss of crop. In cutworm-infested areas it is important that growers should look for the caterpillars in the very early stages of growth of the beet, in order that baiting can be carried out before serious damage occurs.

Summary. The above observations show that the cutworms of the Turnip Moth (*E. segetum*) feed on sugar-beet plants from the end of June until lifting time, and are capable of causing severe injury to late-sown crops. No damage has been seen from overwintered cutworms of this species in April and May.

The caterpillars of the Garden Dart Moth (*E. nigricans*)—hitherto unrecorded as a beet pest—caused severe damage to young beet seedlings in the fens in 1935 and 1936. This damage was caused in May and June. Carrots, celery, and brassicas also suffered severely from the ravages of this pest. Experiments show that both species of cutworm are readily controlled by poison baits.

The authors are very much indebted for the facilities afforded by those growers on whose farms the above experiments were carried out, and to Dr. I. Thomas and Mr. O. S. Rose for their interest and help.

THE BLOWFLY IN AUSTRALIA: SOME METHODS OF PREVENTION

GEORGE BERRIE

IN Australia, the blowfly pest runs the rabbit closely for first place, if indeed it cannot claim precedence, for the rabbit can be exterminated—at a price. In spite of careful scientific investigation extending over many years, no method of striking at the root of the trouble has yet been discovered. There are blowfly “experimental farms” in several leading sheep districts, and considerable data have been accumulated as to the fly’s habits. An insect known as the “Chalcid wasp,” which preyed on the pupae of the fly, was imported, but it was ineffectual.

The sheepowner is, therefore, compelled to rely mainly on certain methods of prevention. Unfortunately, conditions in Australia make it impossible to destroy the fly’s breeding-ground in the shape of rotting carcasses in the conscientious way that obtains in Britain. The size of sheep stations, and the large losses of stock that occur during every drought, make it a very difficult problem. It may often happen that a carcass will be discovered miles from the timber necessary to burn it, or that if timber is available it would be madness to run the risk of starting a bush-fire. To bury carcasses in the brick-hard ground in summer time would be impossible. The radius of the fly has been established as being anything up to ten miles, so that even in the more closely settled districts, carcass destruction would need to be universal and compulsory to be effective.

The writer first remembers seeing instances of fly-blown sheep thirty odd years ago. Before 1902—the concluding year of one of the country’s most calamitous droughts—no sheep, no matter how dirty or daggy, became maggot-infested, and lambs were tailed by the million and let go without being dressed. No satisfactory theory as to why the fly suddenly decided to attack sheep has yet been propounded. One favourite argument is that wholesale rabbit poisoning provided the fly with a more extensive breeding ground and at the same time took a heavy toll of bird life that might have kept it in check. The theory is untenable for two reasons. One is that

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every periodic drought provided more than sufficient in the way of breeding ground, and that the fly was just as countless long before it selected wool as a depository for its eggs. Another is that at the present day there are places in Queensland, hundreds of miles from where a rabbit has ever been seen, let alone poisoned, and the ravages of the fly are as serious there as anywhere. It is much more likely that the development of the merino sheep and a certain constitutional alteration is at the bottom of the trouble.

Crutching. Of the two main methods of prevention, crutching and jetting, the former is the more popular. There are, of course, seasons when the fly will strike anywhere and everywhere and nothing short of complete shearing will really relieve matters, and then only for a time. Ordinarily, however, crutching, if properly done *before* the fly begins its attack, and twice with hoggets and maiden ewes, will carry a flock from shearing to shearing with a minimum of trouble. Machine shears are, of course, an essential; the closest work with blades is of little use. The wool is closely shorn from below the udder and the inside of the legs round the thighs to just above the butt of the tail. If shearing has taken place in the spring—it varies widely according to climatic conditions—several months' immunity may be looked for in ordinary seasons. By midsummer the wool has grown sufficiently to have become dirt-stained and to provide the fly with a striking ground. The experienced manager does not wait until the fly begins to work; he puts his whole flock through the shearing shed and insists on the work being thoroughly done. The cost is about 7s. 6d. per 100, and a competent crutcher will do from 300 to 400 in an eight-hour day. As with the ordinary shearing, much of the work is done by contractors, particularly on larger sheep stations. They bring complete teams of men, and the crutched wool, if of sufficient length, is sorted and pressed as shorn. On smaller farms, the owner often does his own crutching, either with his permanent employees or the help of his immediate neighbours.

If lambing does not take place until some months after crutching, the ewes may be done again—as close to lambing as may be considered safe. If seasonal conditions are favourable they are left severely alone during the lambing period, and the necessity for making them fly-proof will be at once apparent. In addition, the absence of wool for several

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inches around the genital organs makes for both ease and cleanliness.

It may also be necessary to crutch hoggets and maiden ewes a second time at the end of the winter, to avoid a possible attack in the early spring before the general shearing. The extra wool and consequent dirt on younger sheep make them more attractive to the fly. Lambs are invariably shorn with the rest of the flock and three to four months is considered a suitable age. It is very rare to see merino lambs carrying their fleeces round to the following shearing. Even apart from the fly question, they do infinitely better if shorn as lambs.

Jetting. As an alternative to crutching there is jetting. This process merely saturates the wool from the butt of the tail downwards with an arsenical preparation. The jetting plant consists of a small-powered engine and an iron tank sunk in the ground beside it. The liquid is prepared in another and larger tank and fed into the below-ground one as required. It is forced by engine power into a long rubber hose with a fine spray nozzle and release tap at the end, and the pressure is considerable. The jetting is done in a race floored with concrete to allow the drained liquid to run back into the tank. The race may be any length, and its width is usually that of three or four sheep abreast. The operator begins at one end, standing in the race, which is filled as tightly as possible. He works his way back through the sheep and jams the nozzle through the wool at the tail butt right to the skin. The pressure when released is sufficient to saturate the parts immediately surrounding the tail and crutch, and a few seconds per sheep will suffice. Several hundred can be done in an hour by one man. Properly carried out, jetting gives immunity—in an ordinary season—for some months, and once the plant is installed its cost is much less than crutching.

Crutching, however, has one advantage that weighs strongly. Crutched sheep bring a minimum of stained wool and dags into the shearing shed, and a man's labour may easily be saved in the sorting of fleece skirtings. In former times the presence of urine-stained wool in clean skirts was very difficult to avoid and could take pence a pound off their value.

One gathers that in Britain the fly does its worst work

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amongst lambs. To any farmer with a machine plant, the suggestion is made to try shearing a few as an experiment. If it were found that the value of the fat lamb was reduced, if reduced at all, by no more than that of the wool it cut, immunity from fly attack and better growth—which certainly obtain in Australia—would much more than balance the cost of shearing. At two to three months the lamb would cut at least 2 lb. of wool, and on the hogget sold fat during the winter or early spring, the absence of that lamb clip would be scarcely noticeable. Machine shears would naturally be necessary, the protection from fly attack being the prime consideration.

THE GREY BULB ROT OF TULIPS AND ITS CONTROL

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EVEN though they may not be aware of the cause, most growers of tulips are probably familiar with the effects of the Grey Bulb Rot disease, which takes its toll of the plants whether they are grown in outdoor beds or forced in boxes under glass. The total failure of badly-attacked bulbs to produce shoots leads to gaps in the beds or boxes, whilst in milder cases the growths that do appear are either quite crippled at an early stage or consist merely of badly torn, ragged foliage with no flowers (Fig. 1). It is significant that, although the greater part of the bulb itself becomes badly rotted, its root system is usually well developed and sound.

If the abortive bulbs or the diseased growths are examined carefully, there will already be found on many of them the resting bodies, or *sclerotia*, of a fungus (*Sclerotium Tuliparum* Klebahn), and this is the cause of the disease. These sclerotia consist of compacted masses of mycelium or spawn, and are white at first, but turn brown later. When dry they are almost black. They are rounded or roughly spherical in shape, and range from $\frac{1}{8}$ to $\frac{1}{4}$ in. in diameter. Fig. 1 shows these sclerotia developing on an attacked tulip bulb. The food-absorbing mycelium of the fungus is, of course, within the bulb and causing its rapid decay. The sclerotia, built up from this food, enable the fungus to persist through adverse periods and they also secure its dispersal. They reach and accumulate in the soil in which the bulbs are planted, and may, of course, be transported with such soil.

So far as is known at present the fungus does not produce spores, and no epidemic spread of the disease by means of spores occurs. Indeed, numbers of perfectly good flowers are frequently cut for market from the unattacked individuals in boxes in which a proportion of the bulbs have failed completely owing to Grey Bulb Rot. In this respect, Grey Bulb Rot differs markedly from tulip "Fire" (due to *Botrytis Tulipae* (Lib.) Lind), a disease that often leads to almost complete loss through disfigurement of the flowers consequent on rapidly developing infection from air-borne spores in a warm humid atmosphere.

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Darwin tulips are particularly susceptible to attack by Grey Bulb Rot and the disease is not confined to tulips, for it also occurs in Irises (particularly *Imperator* and *Wedgwood*), *Scillas*, *Crocuses*, *Ixias*, *Fritillaries*, *Hyacinths*, *Colchicums*, and *Narcissi*, though usually in less severe form.

It was shown many years ago that the sclerotia can retain their vitality for several years, so that soil containing them remains "infective" for a long period. After a period of rest, and when tulips or certain other susceptible hosts are planted in soil containing them, fresh, vigorous spawn or mycelium develops from the sclerotia, and this, on reaching the bulbs, enters them at or near the nose or attacks any young growth that may already be proceeding from them just at soil level. Thus, the disease usually starts early and the tulip is so vigorously and rapidly attacked that no new bulb can be formed. Rarely, however, attack may start later, on a plant much further developed or even nearly ripe, and then its effects may be comparatively slight; a new bulb may have been produced already, and it may be harvested. Some of the mycelium or even one or two small sclerotia may be attached to the nose of such a bulb; and if it is not discarded during cleaning and sorting operations, the bulb will carry the parasite with it to garden or forcing-box in the following season. On planting, attack will start again and the bulb will be destroyed. This kind of thing, if it ever occurs, must do so with extreme rarity, and, speaking broadly, Grey Bulb Rot is not a disease that is transmitted with the bulb. Where a substantial attack occurs it can be concluded at once that it arose from contaminated soil and was not introduced with the bulbs.

It has been known for at least a decade that total elimination of the disease can be achieved by steam sterilization of the soil, experimental results having been published by Whetzel and Arthur* in the United States. These workers used the "pan" method, outdoor beds being treated for one hour. In Holland, too, this method has been employed by Van Slogteren.† Experiments made by the present writer have also shown the excellent effect of routine soil "steaming." Some of the results will be found in the figures given in Table I, and they are also illustrated in Fig. 2.

* Whetzel, H. H., and J. M. Arthur: Cornell Agric. Exp. Sta., Memoir No. 89, 1925.

† Van Slogteren, E.: *Floralia*, XLVI, 547, 1925.

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Disinfection of contaminated soil with various chemicals has also been tried by previous experimenters, and the most successful results have been obtained with formalin. Whetzel and Arthur describe plot trials with various strengths of solution, and state that the "results indicate clearly that the bulb rot pathogene may be largely eradicated and a good stand obtained by soil disinfection with formalin." The quantity recommended is 1 to 1½ lb. of the commercial liquid added to an amount of water sufficient to penetrate the loosely dug soil to a depth of 6 to 8 in., per 5 to 6 square feet.

The writer has had considerable experience with the experimental forcing of tulips, and has repeatedly obtained almost perfect control of another tulip disease, Shanking,† by copiously treating the contaminated soil when in a comparatively dry condition, several weeks before planting, with a 2 per cent. solution of commercial (38 per cent.) formalin, the soil being kept covered for a few days after treatment. With Grey Bulb Rot, however, similar treatment has proved quite ineffective. Results of some of the trials are included in Table 1 while the point is also brought out in Fig. 3, right-hand box.

Clearly, the sclerotia of the Grey Bulb Rot fungus are much more resistant to the action of formalin than the two fungi responsible for Shanking. Quite probably the soil used in the boxes illustrated was more heavily contaminated with sclerotia than the soil of the outdoor beds treated by Whetzel and Arthur, but even these workers claimed only a better "stand" of plants in the treated soil, and that the fungus was "largely eradicated"—not completely eliminated.

More satisfactory results were obtained by thoroughly incorporating a fungicidal powder, not containing mercury but in which the effective constituent is believed to be a chloronitrobenzol preparation, with contaminated soil at the rate of 12 oz. per cubic yard, several weeks before planting. A second dose of the powder, at the same rate, was applied to the top soil in the boxes when the bulbs were "boxed." The results of the experiment are included in Table 1.

Before describing a simple way of escape from the worst effects of this disease, it should be stated emphatically that the ideal is undoubtedly a vigorous attack on the causative

† See Gard. Chron., 87, March, 1930, 171. Experiments at Reading have shown that Shanking is caused by *Phytophthora cryptogea* and by *P. erythroseptica*, both of which are soil-infesting fungi.



FIG. 1. Tulip bulb attacked by Grey Bulb Rot. The rounded white masses are young sclerotia or resting bodies of the fungus.



FIG. 2 — Tulips grown in soil badly infested with the Grey Bulb Rot fungus. The soil in the box on the left was steam sterilized and no plant was attacked. In the untreated soil, on the right, only one plant reached the flowering stage.

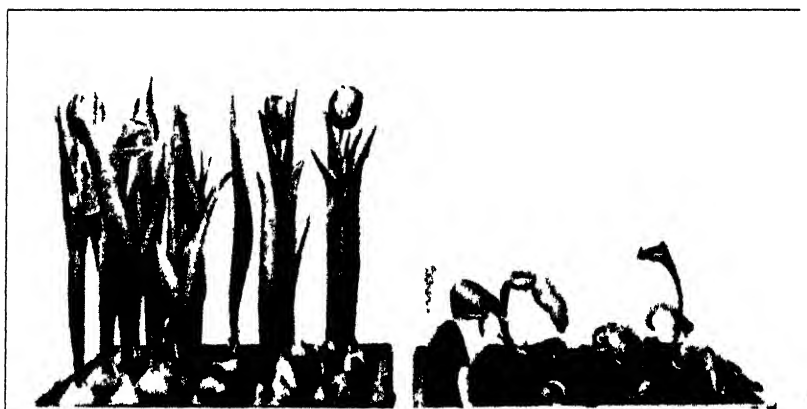


FIG. 3 — Tulips grown in soil infested with the Grey Bulb Rot fungus. On the left bulbs planted with upper halves exposed, 21 healthy plants resulted. On the right, bulbs planted in the ordinary way, soil treated with formalin, but not a single healthy plant resulted.

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agent as soon as it is first noticed, with the object of effecting its complete elimination from the garden or nursery. Good general sanitation, or plant hygiene, is inseparable from good gardening. In outdoor plantings particularly, as soon as a plant is seen to be attacked by Grey Bulb Rot, it should be carefully dug up, together with any visible fungus growth, including sclerotia, that may be present. A reasonable amount of the surrounding soil should also be removed, and the whole should be burned, or buried deeply. At the same time, or even earlier, "misses" should be investigated, and the rotting bulbs dealt with similarly. Apart from any soil treatment an adequate rotation of cropping must be followed on any soil in which the disease has occurred, each and every one of the susceptible hosts being kept off for a period of four or five years, and special attention being given to "rogues" or "ground keepers." For forced bulbs, fresh clean soil, clean boxes, and uncontaminated ashes must be used.

While infested soil continues to remain in the garden or nursery, serious and unexpected losses are apt to occur, but growers who find soil sterilization impossible, or who cannot obtain clean soil, may find it worth while to resort to a modified system of planting, devised by the writer, and now to be described, that will almost certainly enable them to obtain a fair crop of forced tulips, even in contaminated soil.

It has already been pointed out that tulips attacked by Grey Bulb Rot show good root development. It has also been noticed during experimental work extending over some years, and in the course of examination of numerous outbreaks of this disease in commercial nurseries and private gardens, that it is chiefly the very young shoots pushing through the soil that first become badly attacked by the fungus. Plants that escape attack during this stage and look reasonably healthy a week or so after the boxes have been taken indoors, usually produce flowers of good quality, even when their immediate neighbours may fail entirely. These observations suggested that heavy losses might be avoided even in badly-contaminated soil, by planting in such a way that one-half to two-thirds of each bulb is exposed above the soil level. Experiments carried out along these lines have fully justified this supposition.

Other conditions being ideal, it seems that the very best results in forcing tulips are obtained by plunging the boxes into a bed of well-washed ashes, as soon as the bulbs have

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been planted. In this way the soil, bulbs and roots are kept cool and moist during the autumn months while the root system is developing. In commercial nurseries this method is often impracticable, and it is usual for the forcer of large numbers of bulbs to cover his planted boxes outdoors with a layer of straw. In the best practice the bulbs for forcing are inserted so that their "noses" are either only barely visible or are just covered with soil. A good depth of soil for the roots is, of course, necessary, and with the shallow boxes commonly used, equally good results are obtained (even in the absence of disease) by shallow planting, provided watering is well done. It was therefore but a small step forward to proceed with the idea of inserting the tulip bulbs with their noses projecting clear above soil level, and covering the boxes during the preliminary rooting period with good, long straw. The experimental results (obtained in a wet autumn) showed that not only could a good crop of flowers be obtained by this method, but also that it has considerable advantages when the soil employed is badly infested with the sclerotia of the fungus responsible for Grey Bulb Rot.

TABLE I

Showing the Number of Healthy Plants arising from 25 William Copland Tulip Bulbs planted in Infested Soil in each Box after the Treatments indicated

<i>Treatment</i>	<i>Soil A</i>	<i>Soil B</i>	<i>Soil A + B</i>
Soil untreated	0	0	—
Duplicate; soil untreated	1	—	—
Soil steamed	25	25	—
Soil treated with formalin	0	1	—
Soil treated with powder	13	21	+ +
Soil untreated; bulbs shallow-planted, covered with long straw during rooting	21	24	22

It will be seen from Table I that nearly 90 per cent. of the plants were thus enabled to "escape" the fungus in each of three badly contaminated samples of soil. Comparable plants growing in the same infested soil untreated were almost a total failure and are shown on the right in Fig. 2. Fig. 3 shows clearly the difference in development in the same contaminated soil of Copland tulips planted with projecting noses and covered with straw and those planted and "plunged" in the ordinary manner, even in soil that had been treated with formalin.

Unfortunately, considerable fluctuations of temperature were unavoidable in the only glass house available for the

GREY BULB ROT OF TULIPS

experiments, and thus many of the flowers failed to develop normally. However, the numbers of normal healthy plants obtained afford an adequate basis for comparison of the various treatments.

Since the above account was written the results of a further series of experiments, made during the past forcing season, have become available. The soil was obtained from a commercial nursery. In the spring of 1936 a crop of Iris grew in it and was slightly infected with Grey Bulb Rot. The soil was well mixed, placed in boxes and subjected to the treatments shown in Table 2, twenty-five William Copland tulips being planted in each box and flowering taking place early in January, 1937.

TABLE 2

Showing the Number of Marketable Flowers produced from 25 William Copland Tulip Bulbs planted in Infected Soil in each Box after the Treatments indicated

	<i>Treatment</i>					<i>Marketable Flowers</i>
Soil untreated	1
Soil steamed	44
Soil treated with formalin	9
Top soil treated with powder	23
Soil untreated ; bulbs shallow-planted, covered with long straw during rooting..	22

The best growth was in the contaminated soil that had been steam sterilized, but the bulbs planted with projecting necks " escaped " from attack and flowered very well. Soil treatment with formalin was again unsatisfactory. The non-mercurial fungicidal powder, when mixed with the top soil only at the time of boxing at the rate of 14 oz. per cubic yard of soil, gave a good stand of plants, of which 90 per cent. flowered successfully. The results of this second series of experiments therefore confirm those of the previous season.

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Milk Marketing Scheme. Pool prices and rates of producer-retailers' contributions for February, 1937, are given below, with comparative figures for January, 1937, and February, 1936. The monthly wholesale liquid milk price was 1s. 5d. per gal. in each period.

Region	Pool Prices			Producer-Retailers' Contributions		
	Feb. 1937	Jan. 1937	Feb. 1936	Feb. 1937	Jan. 1937	Feb. 1936
	d.	d.	d.	d.	d.	d.
Northern	14	14	13½	2½	2½	3½
North-Western	14	14	13½	2½	2½	3½
Eastern ..	14½	14½	13½	2½	2½	3½
East Midland	14½	14½	13½	2½	2½	3½
West Midland	13½	13½	13½	2½	2½	3½
North Wales	13½	13½	13½	2½	2½	3½
South Wales	14	14	13½	2½	2½	3½
Southern..	14½	14½	13½	2½	2½	3½
Mid-Western	13½	14	13½	2½	2½	3½
Far-Western	13½	13½	13	2½	2½	3½
South-Eastern	14½	14½	14	2½	2½	2½
Unweighted Average	14·07	14·05	13·39	2·57	2·59	3·21

These prices are exclusive of any premiums for special services and level deliveries, and also of the Accredited Producers' premium of 1d. per gal.

The number of producers who qualified for the accredited premium was 19,170 and the sum required for the payment of the premium was equivalent to a levy of 352d. per gal. on pool sales.

The inter-regional compensation levy was fixed at 1½d. per gal., compared with 2d. per gal. in February, 1936. A levy of ½d. per gal. was made for general expenses.

Sales on wholesale contracts were as follows:—

		Feb., 1937 (estimated)	Feb., 1936
		Gal.	Gal.
Liquid .. ..	..	45,024,857	44,547,968
Manufacturing .. ..	..	14,976,520	20,511,210
		60,001,377	65,059,187
Percentage liquid sales .. ..	..	75·04	68·47
Percentage manufacturing sales .. ..	..	24·96	31·53

The average realization price of manufacturing milk during February was 6·26d. per gal., compared with 5·88d. per gal. for February, 1936. The quantity of milk manufactured into

MARKETING NOTES

cheese on farms was 342,674 gal. compared with 351,617 gal. in the previous month and 369,803 gal. in February, 1936.

Increase in Sales of Milk for Liquid Milk Consumption. In each month since June, 1936, the consumption of liquid milk has been at a higher level than in the corresponding month of the previous year. According to the Board's provisional estimates, contract sales of liquid milk have increased over the corresponding months in the previous year as follows:—

	<i>Per cent.</i>		<i>Per cent.</i>
1936—June	1·5	1936—October ..	0·8
„ July.. ..	1·0	„ November ..	2·0
„ August	1·7	„ December ..	3·5
„ September ..	1·7	1937—January ..	4·4
		„ February ..	4·3

Since there was 1 day less in February, 1937, than in February, 1936, the increase has been calculated on the average daily sales for those months.

Potatoes from Northern Ireland. The North of Ireland Potato Marketing Association and the Potato Marketing Board have made a covenant regarding the shipment of potatoes from Northern Ireland into Great Britain. The Association agree to limit shipment to 200,000 tons in a year when United Kingdom supplies appear to be in excess of the demand, and also agree to conform to certain specified marketing practices.

Hops Marketing Scheme. Sales of 1936 hops to date are slightly below the estimated market demand, and there is likely to be a call on the levy fund provided by the brewers. Meanwhile, the Hops Marketing Board will make a further payment on account to growers.

Pigs and Bacon Marketing Schemes: Elections of Board Members. Elections of district members of the Pigs Marketing Board held on February 27, 1937, resulted in the return of the sitting member for Scotland, Mr. J. Blackley, and the election of Mr. N. S. Perkins in the place of Mr. M. T. Davies for Wales. The retiring members for the West Midland and Northern districts, Mr. J. H. Wain and Mr. J. A. Fox, were returned unopposed. Captain E. T. Morris has been returned unopposed as a special member.

The annual elections of representative members of the Bacon Marketing Board, held in Scotland on February 17, and in England on February 24, resulted in the return of all the retiring members.

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Milk Acts, 1934 and 1936 : Manufacturing Milk. Advances made by the Ministry up to March 15, 1937 in respect of manufacturing milk were as follows:—

Section of Act		Period of Manufacture	Quantity	Advances
	<i>(a) Milk Marketing Board for England and Wales</i>			
	In respect of milk		Gallons	£
1	Manufactured at factories other than the Board's	April, 1934, to Jan, 1937	502,550,631	2,155,465
2	Manufactured by the Board ..	April, 1934, to Sept, 1935	2,573,662	12,850
3	Made into cheese on farms ..	April, 1934, to Dec, 1936	43,658,147	193,078
	* Total for England and Wales		548,782,440	2,361,393
	<i>(b) Government of Northern Ireland</i>			
	In respect of milk			
6	Manufactured into cream and butter at registered creameries ..	April, 1934, to Dec, 1936	65,079,569	385,200
	TOTAL		613,862,009	2,746,593

*Owing to the Cheese-Milk Prices for August and September, 1936, being in excess of the Standard Price, no subsidy was payable in respect of milk produced and manufactured in these months.

Cheese-Milk Price. For the purpose of payments under the Milk Acts, 1934 and 1936 (whether by the Exchequer to Milk Marketing Boards or by Boards to the Exchequer) in respect of milk used for manufacture, the Cheese-Milk Price has been certified by the Minister and the Secretary of State for Scotland to be 4 90 pence per lb. for the month of March, 1937.

Wheat Act, 1932 : Sales of Home-Grown Wheat, Cereal Year, 1936-37. Certificates lodged with the Wheat Commission by registered growers during the period August 1, 1936, to March 5, 1937, cover sales of 15,488,859 cwt. of millable wheat as compared with 24,544,811 cwt. in the corresponding period (to March 6) in the last cereal year.

Advance Payment to Registered Growers on account of Deficiency Payments for 1936-37. In accordance with their By-law No. 31 the Wheat Commission have decided to make

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a payment in advance to registered growers on account of deficiency payments that will become due under the Wheat Act for the cereal year ending July 31, 1937. This advance will be made in respect of all proper applications received from registered growers on valid wheat certificates delivered to the Commission on or before Thursday, March 18, 1937.

The payment that will be made on or about April 17, 1937, will be at the rate of 8*d.* per cwt. equal to 3*s.* per quarter of 504 lb.

Wheat Fund Accounts. The account of the Wheat Fund showing the revenue and expenditure attributable to the cereal year ended July 31, 1936, together with the Report of the Comptroller and Auditor General thereon is now available. Copies can be obtained from H.M. Stationery Office or through any bookseller—price 2*d.* net.

Sugar Industry (Reorganization) Act, 1936 : Production of Home-Grown Beet Sugar, during the 1936-37 Campaign.

According to information furnished to the Ministry by the British Sugar Corporation, Limited, the total quantities (cwt.) of beet sugar manufactured in Great Britain during February, 1937, were :—

<i>White</i>	<i>..</i>	<i>Raw</i>	<i>..</i>	<i>Total</i>
56,107	..	5,897	..	62,004

The 1936-37 campaign has now closed and the total quantities (cwt.) of sugar produced during the campaign, with corresponding figures for the 1935-36 campaign, were :—

	<i>White</i>	<i>Raw</i>	<i>Total</i>
Campaign 1936-37 ..	5,375,716	5,371,613	10,747,329
„ 1935-36 ..	4,339,975	5,406,525	9,746,500

Supplementary Payments to Growers for Poor Crop. In pursuance of the provisions of the Sugar Industry (Reorganization) Act, 1936, the Minister, after consultation with the Sugar Commission, has considered the outcome of the 1936 sugar-beet campaign, and has decided that no supplementary payments fall to be made to growers in respect of the 1936 crop.

Cattle Fund. The table on p. 64 gives particulars of payments made under the Cattle Industry (Emergency

MARKETING NOTES

Provisions) Acts, 1934 to 1936, and shows the numbers of animals marked on importation into Great Britain:—

	April 1, 1936, to Feb. 28, 1937	April 1, 1935, to Feb. 28, 1936	*Sept. 1, 1934, to Feb. 28, 1937
Payments	£3,632,792	£3,519,323	£9,530,148
Animals in respect of which payments were made .. .	1,544,342	1,483,789	4,021,400
Average payment per animal ..	£2 7 0½	£2 7 5	£2 7 5
Imported animals marked at Ports (Great Britain only)	520,667	444,587	1,263,819†

* Commencement of subsidy payments.

† As from August 6, 1934

Trade Agreement with Canada. The Trade Agreement made with Canada at Ottawa in 1932 has been superseded by a new Agreement signed on February 23, 1937. The new Agreement is terminable at any time on or after August 20, 1940, subject to six months' notice having been given by either side. The earliest date of termination is thus exactly three years after the earliest date of termination of the 1932 Agreement. The principal agricultural products affected are dairy produce, bacon and hams, beef and cattle.

Canadian produce at present free of duty, will continue to enjoy free entry into the United Kingdom, subject to the reservation by the United Kingdom Government of the right to impose duties on Canadian eggs, poultry, butter and cheese, and other milk products, or to subject these products to quantitative regulation. This reservation is subject to the provisos that existing margins of preference on these products will be maintained, and that quantitative regulation, if introduced, will apply to imports from all sources. Existing margins of preference are also guaranteed on a number of Canadian products not covered by this reservation that at present enjoy free entry.

The Canadian Government recognize that the promotion of orderly marketing is the United Kingdom Government's policy in respect of bacon and hams, and cattle and beef, and they agree to assist in the execution of this policy as far as possible. In accordance with the United Kingdom Govern-

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ment's declared policy, free entry of imports of these products from Canada is guaranteed. The new Agreement modifies the undertaking in the earlier Agreement in respect of supplies of bacon and hams from Canada by giving the United Kingdom Government the right to regulate imports from Canada if they expand towards the $2\frac{1}{2}$ million cwt. maximum at an abnormal rate such as to endanger the effective working of the system of supply regulation. Any regulation of imports from Canada will only be initiated after consultation with the Canadian Government.

Canada falls in the group of the smaller supplying countries concerned in the International Beef Conference arrangements, and the United Kingdom Government therefore promises, if requested, to represent Canadian interests at the Conference and to endeavour to secure for Canada an equitable share of the market. The Agreement embodies certain other provisions in conformity with the Beef Conference Scheme, and, as with bacon and hams, it gives the United Kingdom Government the power to regulate imports of beef and cattle from Canada if, after consultation with Canada, this appears essential for the effective working of a general scheme for orderly marketing in this country.

Trade Arrangement with Irish Free State. On February 25, 1937, the Secretary of State for the Dominions gave the following reply to a question asked in the House of Commons:—

MR. M. MACDONALD: In reply to the hon. Member for Colchester (Mr. O. Lewis) on January 19, I stated that it had been agreed to continue, for a further period of one year, the trade arrangement with the Irish Free State concluded at the beginning of 1936, subject to possible modifications of detail. As a result of subsequent discussions it has now been agreed to make minor adjustments in the arrangements for the regulation of United Kingdom imports of cattle and bacon from the Irish Free State during 1937. Further, the United Kingdom Government have agreed to remove the present special duty of 20 per cent. *ad valorem* on live horses imported from the Irish Free State. The Irish Free State Government, for their part, have agreed to remove the existing emergency duties on sugar and subsidiary products imported from the United Kingdom. Treasury Order removing the United Kingdom special duty on horses will be made at once and come into force on Monday. I understand that the Irish Free State Order removing the emergency duties on sugar will also take effect on Monday.

The minor adjustments referred to provide for a limited switch from fat to store cattle on the basis of the 1936 allocations, and for a 5 per cent. increase in the bacon allocation.

MARKETING NOTES

Regulation of Imports of Meat, July to December, 1936.

The following statement shows imports of meat from Empire and foreign countries in the second half of 1936 (the whole year as regards mutton and lamb from Empire countries) compared with the agreed maxima and allocations:—

	Empire Countries		Foreign Countries	
	Agreed Maxima 000 cwt.	Imports 000 cwt.	Alloca- tions 000 cwt.	Imports 000 cwt.
Chilled and Frozen Beef and Veal	1,998.1	1,860.3	1,380.7*†	1,300.5*
Frozen Mutton and Lamb	5,650.0†	5,030.0†	517.7	507.2
Frozen Pork (excluding pork for curing) ..	280.5	151.0	188.0	129.3

* Excluding tongues.

† Figures for the whole year.

‡ Includes 107,080 cwt. chilled beef carried forward from 1935, and 70,400 cwt. of frozen beef allowed in lieu of frozen beef replaced by chilled beef in the first half of 1936

Regulation of Imports of Bacon and Hams. In the light of a recommendation of the Market Supply Committee, it has been decided that the foreign bacon quota for the second quarter shall be fixed provisionally at the rate operative in the first three months of the year. The allocations to the individual foreign exporting countries for the period April 1 to June 30, are as follows:—

Country	Allocations Cwt. (a)
Denmark	838,953
Netherlands	125,513
Poland	105,034
Sweden	62,096
Lithuania	38,975
Estonia	9,909
Finland	5,285
Latvia	9,248
U.S.S.R.	11,230
Argentina	9,248
U.S.A.	105,695
Allowance for imports from foreign countries not scheduled to the Bacon (Import Regula- tion) Order .. *	31,964
TOTAL	1,353,150

(a) Subject to amendment, as regards certain individual countries, in respect of overshipments or undershipments in previous periods.

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National Mark Dressed Poultry. The aggregate output of the authorized packing stations during 1936 was 1,547,561 birds, of which 337,905 were packed under National Mark labels, including 15,764 turkeys and 713 geese that were graded and marked under the special National Mark Christmas Scheme for Turkeys and Geese.

The National Mark Scheme for dressed poultry now provides for the packing of the various specified classes of poultry under two grades, namely, Select and Prime. The number of birds packed during 1936 under these grades was 228,755, and 109,150 respectively.

Inspections of National Mark dressed poultry during the year indicate that authorized packers in the scheme are complying satisfactorily with the prescribed standards both in regard to the quality of their produce and the method of packing. The introduction of the Prime grade has met generally with the approval of both the packers and the wholesalers. It is anticipated that the inclusion of this grade will lead to a steady increase in the quantity of graded poultry available on the market.

National Mark Creamery Butter Scheme. During the 12 months ended December 31, 1936, the output of all authorized packers of National Mark creamery butter amounted to 24,428 cwt. pre-packed in retail packages, and 5,798 cwt. packed in bulk containers, a total of 30,226 cwt. The corresponding figures for the first 11 months of the scheme (January 28-December 31, 1935) were 12,156 cwt. pre-packed butter and 2,192 cwt. butter in bulk, totalling 14,348-cwt.

Union of South Africa : Agricultural Marketing Bill. A note in the August, 1936, issue of this JOURNAL (p. 474), outlining the proposals contained in the Union Government's Marketing Bill, concluded with an intimation that the Bill was not likely to be proceeded with until time had been allowed for fuller consideration of its proposals. Eventually, it was decided not to proceed with the 1936 Bill, but to introduce a new one.

The new Bill differs from that of 1936 principally in the proposals for central organization; the provisions as to marketing schemes and boards remain substantially unchanged. The somewhat cumbrous machinery contemplated in the previous Bill for the investigation of marketing schemes has been simplified, and in place of the Agricultural Advisory

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Council and the Agricultural Investigation Board previously envisaged, it is now proposed to establish a National Marketing Council, consisting of two officers of the Department of Agriculture and Forestry, as chairman and deputy chairman, and three other members appointed by the Governor-General.

The National Marketing Council is to carry out investigations and to advise the Minister on marketing matters generally. It is to examine and report on schemes submitted and may itself draft schemes or submit amendments to existing schemes. It is also to exercise a measure of control over schemes in operation. Each board is to render to the Council an annual report on its activities, and the Council is to report to the Minister at least once in every year as to schemes in operation. The Minister may recover from boards certain of the expenses of the Council relating to schemes. The Council is given power to carry out inspections and to require the audit of accounts, and it is to report to the Minister on any decision of a board to fix prices or restrict the channels of sale or the grade or quantity of the regulated product that a producer may sell. Before reporting to the Minister on any investigation concerning the fixing of prices, it must consult the Board of Trade and Industries. It may recommend to the Minister the prohibition or regulation of imports or exports.

Regulatory boards may be assisted out of an agricultural marketing fund provided by Parliament, but all advances so made must be repaid within five years. Regulatory boards may also borrow from the Land and Agricultural Bank against suitable security.

Provision is also made for the establishment of a Producers' Advisory Committee and a Consumers' Advisory Committee, to be appointed and convened by the Minister. These Committees are to act in an advisory and consultative capacity, and may make representations to the Minister and the Council on matters affecting the interests they serve.

One of the purposes of the Bill is to provide a statutory basis for the voluntary National Mark Scheme, which, as stated in the December, 1936, issue of this JOURNAL (p. 887), was recently introduced in respect of certain products. The Governor-General may prescribe a National Mark for application, under certain conditions, to any product in connexion with its sale in any area or at any place.

APRIL ON THE FARM

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THE present month is one of great activity on farms of every type. "Nature" makes a definite step forward and the farmer makes haste to keep pace with her.

As regards live stock, the welcome prospect of relief from expensive winter keep is keenly anticipated, and the progress of pastures is a matter of close observation. Winter corn gives definite indications as to the possible crop at harvest, while spring corn, potatoes and root crops all receive the attention of the arable farmer.

The weather conditions of the previous winter months have a very definite effect on April prospects both as regards availability of pasturage and the condition of the land to receive the seed of spring-sown crops.

In most districts little spring work has been possible owing to the sodden condition of the soil following frequent heavy rain. The rainfall since the beginning of the year in the north of England, as in most parts of the country, has been much more than the average, with the result that a larger amount of work than usual remains to be tackled by the arable farmer.

The present spring promises to be one in which the advantages of mechanization in helping work forward will be fully appreciated.

In a late season when work cannot be hurried forward the tendency is to plant or sow without obtaining really good cultural conditions, or if suitable conditions are to be obtained sowing may have to be delayed. Either of these contingencies will add to the risk of failure or reduced yield.

Sheep. On lowland farms lambing is practically finished and ewes and lambs are away from the lambing pens on to the pastures. Risks associated with the early days of the lamb's life are over and the object now is to promote growth and well doing. On the early farms many lambs will already have been sold fat and others will be nearly ready for market, but most of the lambs are but a few weeks old and at the stage when a check may result in considerable financial loss.

On many farms succulent foods are running short and can

APRIL ON THE FARM

only be replaced by young grass. Nothing can equal young grass for nursing ewes in April, but on short pastures it is most important to keep the concentrates going until enough grass is available. Lambs to be sold fat at an early age need to be encouraged to eat concentrates, but it is important that the milk supply of the ewes should be maintained. The lambs should as far as possible be fed through the ewes.

The application of a nitrogenous fertilizer as a top-dressing to pasture may do much to speed up growth in a late season and prove a profitable investment. Two or three shillings less price per head at weaning time may mean a greater loss than the expenditure of a few pounds on a top-dressing.

On hill farms ewe hogs return from lowland winter grazings at the beginning of the month and ewes commence lambing from about April 8. The hill farmer is more completely dependent on the weather for food than his lowland neighbour. On most hill farms no supplementary food apart from hay is supplied. Losses are usually higher on these farms. Quite frequently a crop of lambs may be practically 100 per cent. at birth and 70 per cent. or less at weaning time. Diseases take a heavy toll of ewes and lambs on many hill farms during April. Investigations have shown that these losses are due to a number of different diseases, several of which are preventable. Lamb dysentery, pulpy kidney disease, braxy, and pining are all preventable diseases, and flockmasters should endeavour to obtain an accurate diagnosis of the trouble. In all instances it is best to submit one or two dead lambs to an expert and invite his opinion. Diseases carried by the sheep tick are also very important, especially in the north of England, and control by modern methods of dipping is giving encouraging results in trials now being carried out in Northumberland.

Cattle. Outlying cattle will now respond to improved weather conditions, and in the earlier districts will find an increasing amount of food from the pastures.

Many sales of store cattle take place at this time of the year, and it is interesting to note the value placed on "hair" at the different sales. Outwintered cattle usually command quite a few shillings a cwt. more than cattle wintered indoors. It is right that they should, as cattle wintered indoors experience a much greater change when they go out to grass. If this change can be made gradually it is an advantage,

APRIL ON THE FARM

although it is not always practicable. At Cockle Park for a number of years blue-grey stirks seven months old were wintered in two lots, one of which was out of doors and the other indoors under good conditions in light airy yards. At the end of March the valuers invariably placed a much higher value on the outwintered cattle, usually from 30s. to £2 per head, in spite of the fact that they were nearly $\frac{1}{4}$ cwt. lighter than those wintered indoors. After both lots had been at grass for a period of six weeks, practical farmers could not distinguish the two lots. It should be noted that the management of both lots was as good as could be desired. The cattle wintered out of doors cost as much for food as those wintered indoors.

Most stockmen recognize the value of the type of feeding animals have had before purchase, but there is no doubt that in the spring it is as important to know the conditions under which the animals have been housed. Animals badly housed in dark, ill-ventilated buildings make very slow progress for some considerable time after going to grass.

Dairy cattle in the south will be turned out during the greater part of the month, but in the north, April as a rule provides little out-door keep, and with roots finished on many farms it is often an expensive month for milk production. Ventilation needs to be carefully watched when dairy cattle are indoors, otherwise cowsheds may be much too warm with warmer atmospheric conditions. A thermometer should be part of the normal equipment of a cowshed, and it is desirable that the temperature should not exceed 52° F.

During damp weather, pasture may be unduly laxative, and with high-yielding cows it is often advisable to restrict the grazing and feed a little roughage. When concentrates are being fed less protein can be used and a starchy or carbohydrate food, e.g., a cereal, provides a better balanced diet along with young spring grass.

Many owners of dairy herds are considering the question of the establishment of tubercle-free herds. At this time, when cows are changing their winter quarters, a start can conveniently be made. It is wise to consult a veterinary surgeon. Good advice if faithfully carried out may avoid many pitfalls and disappointments. Farmers who are considering the establishment of a tubercle-free herd will be well advised to consider at the same time the advantages to be derived from a herd which is also free from contagious abortion.

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Meadow Hay. Very often permanent meadow-hay ground is required during the month for grazing ewes and lambs. On hill farms enclosed meadows are particularly valuable and are often eaten well into May.

The maximum amount of hay is required from these meadows for winter sheep feed in bad weather. Purchased hay can only be secured at a relatively high price and transport is often a very difficult matter also. Hill flockmasters usually prefer hay grown on the farm.

Experiments carried out on several hill farms in Northumberland by Pawson and Wannop, have shown that very considerable increases in the quantity of hay produced can be secured, in most instances, by judicious complete manuring. A report on trials carried out in 1935 at three centres shows increases of from 33 per cent. to over 200 per cent. yield in addition to improved feeding value.

Grass and Clover Seeds are sown on most farms in April. Much difference of opinion exists as to the best method of sowing. It is essential, however, to have a fine seed-bed. Tilth and firmness greatly help in plant establishment. What counts most is not the number of seeds per acre that may be sown or even the number that germinate, but those that become established and produce a plant. How often the seedsman is blamed for failure of seeds, when the real reason is cultural and weather conditions! Purity and germination are a useful guide in the purchase of seeds, but strain and origin of stock are also of importance. Low-priced grass and clover seeds are not necessarily the least costly. Good, vigorous, reliable strains should be asked for, and reliable seedsmen will usually be able to supply them. In the seed trade, as in most others, we usually get what we pay for. It is not enough to make purity and germination the only considerations in the purchase of seeds.

Cereals. A much larger acreage of cereals will be sown in April than is usual. Correct seeding is an important matter. Varieties with large grain and poor tillering properties need a much heavier seeding than small-grained varieties or varieties that tiller well. Sandy oats sown at the rate of 2½ bus. per acre have given a thicker crop at Cockle Park than Yielder sown at 6 bus. per acre. Where cultural and climatic conditions are favourable a lighter seeding is needed

APRIL ON THE FARM

than on soils in exposed situations where poor tilth has been obtained.

After the wet winter of 1935-36 nitrogenous fertilizers gave profitable returns when applied as a top-dressing to both autumn- and spring-sown corn. Much available nitrogen will have been lost from the soil during the wet periods of the last few months, and 1937 promises to be another year when nitrogenous top-dressings will leave a profitable return. When sulphate of ammonia is being used, care should be taken not to apply it when white frosts are occurring followed by bright sunshine.

Potatoes and Root Crops. It is often said: "Plant potatoes when you will, they won't grow till April." The vagaries of our climate and the volume of spring work on arable farms, makes it desirable to get on with the work whenever favourable opportunities occur after the beginning of March. In a late season, such as the present, the advantage of sprouting will be found by those who adopt this practice.

Experiments have shown that sprouting in boxes, even in an early season, gives the advantage of an increase in crop. Where planting has to be delayed, even greater advantages are obtained. Boxed sets have made some growth and are ready to make rapid progress, while unboxed seed tubers left in the clamp until late spring have produced long white sprouts that are invariably broken off in handling before planting, and secondary shoots have to be developed, so delaying the start of the crop.

Marrow Stem Kale has increased in popularity as a root crop, and larger acreages are being sown. It is in many ways a more certain crop than swedes. The period during which it can be sown with reasonable prospects of a crop is longer. Sowing may commence from early April and extend to June. It suffers rather less from the turnip fly, and once a crop is established it can be pushed on by liberal top-dressings to produce a heavier weight of crop per acre than swedes on most soils. While it is undoubtedly a good food for dairy cows, it cannot be stored, and during periods of severe frost it is not always available. The absence of a succulent food after being included in the ration upsets the cows, and it is wise to have a small supply of swedes or other succulent, which can be stored available for such periods. This should be allowed for in planning the root break.

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Too much stress cannot be laid on the importance of a fine seed-bed for root crops. The first essential for a crop is to get the plant established. The quicker this can be done after sowing the better, and a suitable seed-bed greatly helps to this end.

While tractors will work long hours without fatigue, horses during the month will have a heavy time. It is important to do all possible in the way of feeding and careful management to keep horses in condition for the long and hard days ahead. In practice, we frequently do not recognize the need for extra care and attention until the horses have lost flesh and are not so able to stand the strain of long, heavy days.

NOTES ON MANURING

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Manuring for Swedes. Recent experiments on the manuring of this crop have been chiefly concerned with testing the value of some particular fertilizer, e.g., the experiments carried out under the aegis of the Permanent Committee on Basic Slag set up by the Ministry of Agriculture, and with investigating the effects of minor element deficiencies, e.g., the incidence and control of Brown Heart. The results of these experiments confirm the conclusions drawn from the older trials regarding the importance of phosphate for the swede crop.

This is well illustrated by the results of experiments recorded in the 13th and 14th Interim Reports of the Permanent Committee on Basic Slag. These reports give the results of 15 experiments on swedes carried out in the two years 1934 and 1935. All the experimental centres were situated in Scotland, but the results serve to show both the general importance of phosphates for swedes and the superiority of a high-soluble over a low-soluble slag for this crop, even in the North. Phosphate failed to increase the yield of swedes at only one of these 15 centres, and, omitting two centres where the results were irregular, the average yields at the remaining 12 centres were as follows:—

YIELD OF ROOTS, IN TONS PER ACRE

	No Basic Slag	Low-soluble Slag (a)		High-soluble Slag (b)	
		3½ cwt. p.a.	7 cwt. p.a.	3½ cwt. p.a.	7 cwt. p.a.
6 Centres in 1934 ..	6.6	— (c)	13.6	— (c)	18.2
6 Centres in 1935 ..	11.4	17.7	19.5	21.5	23.3

Notes.—(a) Total P_2O_5 = 13.68 per cent.; citric solubility of the P_2O_5 = 23.6 per cent.

(b) Total P_2O_5 = 13.81 per cent.; citric solubility of the P_2O_5 = 89.3 per cent.

(c) Only the heavier dressing was used in 1934.

The single and double dressings supplied 0.5 cwt. and 1.0 cwt. of P_2O_5 per acre respectively, i.e., they were approximately 3½ cwt. and 7 cwt. of slag per acre.

NOTES ON MANURING

The need for a considerable amount of phosphate is shown by the fact that, in 1935, the double dressing of high-soluble slag was better than the single dressing, i.e., $3\frac{1}{2}$ cwt. of high-soluble slag per acre is not always sufficient.

This response to phosphatic manures, combined with the fact that many farmers prefer to apply most of the phosphate for the whole rotation to the root shift, makes it very desirable to give at least 4 cwt. per acre of superphosphate or basic slag to the swede crop, and on many farms this dressing might well be raised to 6 cwt. per acre, especially in districts where heavy crops of roots can be grown and on farms where phosphate is not applied to any other crop in the rotation.

There seems no doubt that basic slag is a suitable source of phosphate in many parts of the country, but it seems wise to use a high-soluble slag for this purpose, preferably one of at least 80 per cent. citric solubility. In the eastern part of England, basic slag can be used provided it is applied *early*, and, again, only a high-soluble grade should be chosen. For late spring applications of phosphate in this part of the country, superphosphate is generally regarded as safer than basic slag, though the latter is sometimes quite satisfactory, especially on the heavier soils. In all districts, on soils hovering on the verge of acidity, basic slag is often preferable to superphosphate, not because the latter makes the soil acid, for in the light of evidence published during recent years such a statement is not true, but rather because of the lime content of the basic slag. It cannot be too strongly urged, however, that where a soil has gone past the borderline of acidity, i.e., has become sufficiently acid to cause serious trouble with crops such as barley, clover, swedes, etc., the most economical course in the long run is to lime the soil and not to try to carry on with slag or any other fertilizer supplying only small amounts of lime. Basic slag, nitro-chalk, nitrate of lime and cyanamide may be satisfactory on soil just bordering on acidity, but their lime content is too small for a normal application of any of these fertilizers to have much effect on the acidity of a definitely acid soil.

One further point in connexion with the choice of a phosphatic fertilizer for swedes, is that this crop has a greater power of using phosphate supplied in the form of ground mineral phosphate than most other agricultural crops commonly grown in this country. Under conditions in which ground mineral phosphate is likely to act fairly quickly,

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therefore, e.g., the heavier soils in wet districts, it is worth while considering this relatively cheap form of phosphate when selecting manures for the swede crop.

Swedes show little response to heavy dressings of nitrogen or potash. Where a good dressing of farmyard manure is used it is not often necessary to include potash in the artificials except where other conditions are favourable to the production of a really heavy crop. In the latter circumstances 1 to $1\frac{1}{2}$ cwt. per acre of sulphate of ammonia or its equivalent can also be used, but in the south and east of England it rarely pays to use any potash, and no more than about $\frac{1}{2}$ cwt. per acre of quick-acting nitrogenous fertilizer should be applied, when farmyard manure has been given. From 1 to $1\frac{1}{2}$ cwt. of nitrogenous fertilizer and $\frac{1}{2}$ cwt. per acre of muriate of potash is usually ample even when no farmyard manure is given. Phosphatic dressings on the lines suggested in the earlier paragraphs should always be applied, however, irrespective of whether the crop has received farmyard manure.

It is perhaps also worth mentioning that here the trouble known as Brown Heart or Raan in swedes has recently been prevented by applying small quantities of borax to the soil. The trouble seems to be most prevalent in parts of Wales and Scotland. The presence of Brown Heart has not, so far, been found to cause any serious reduction in yield, but the feeding value of the roots is said to be reduced, for affected roots become fibrous and their sugar content is reduced. Affected roots show no external sign of the trouble, but when they are cut a brownish discoloration may be seen in the flesh of the root. Such roots are not saleable for human consumption. A good deal has been written on the use of borax for controlling this trouble. A dressing of 20 lb. of borax per acre is usually adequate, but, before adopting this treatment growers are advised to seek the guidance of their County Agricultural Organizer.

Marrow Stem Kale. Many farmers have replaced the swede crop by marrow stem kale, and when its relatively high feeding value is taken into account there is little doubt that it is often a better proposition than swedes, at any rate, during the early part of the winter. The manurial requirements of the two crops are not the same, however, and the farmer who attempts to substitute kale for swedes without adjusting the manurial treatment of his land, is almost certain

NOTES ON MANURING

to be disappointed. Like all brassicas, marrow stem kale should receive a dressing of phosphate, usually about 4 cwt. per acre of superphosphate or high-soluble basic slag, according to circumstances. Farmyard manure is also very desirable for the kale crop especially so since kale differs from swedes in being exceptionally responsive to applications of nitrogenous fertilizer. In some instances dressings of 6 to 9 cwt. per acre of nitro-chalk have been reported as giving a profitable increase in yield, and on the general farm it is quite reasonable to expect a good return from as much as 4 cwt. per acre of a fertilizer such as nitro-chalk or sulphate of ammonia in addition to a dressing of dung. From $\frac{1}{2}$ to 1 cwt. of muriate of potash is also desirable, especially if only a small dressing of farmyard manure is available. Liberal manuring, especially with nitrogen, is essential for heavy yields, and, provided the crop is sown fairly early, the yield increase brought about by fertilizers will more than pay for their cost. Early sowing is important, however, where a heavy yield is required in the early autumn.

Vegetable Growing on the General Farm. The extension of the cultivation of the commoner vegetables to the general farm has seriously affected the growers in the older market-garden areas. The newcomer, adopting the labour-saving devices associated with large holdings, large fields, and mechanized cultivation, has brought about an enormous increase in the supply of these vegetables. Some of the ordinary farm land in East Anglia, growing vegetables for the first time, will yield heavy crops of good quality Brussels sprouts, savoys, cabbage, etc., and there is little evidence to suggest that, for this type of vegetable production, the soil needs to be kept at the high level of fertility usually found in old market-garden land—a level only maintained by lavish expenditure on dung and fertilizers.

At present there seems no reason to anticipate any marked deterioration in the cropping powers of much of this new "cheap" land, and one cannot see any immediate prospect of decreasing competition with market gardeners. As long as such crops are only grown in place of part of the root shift, there can be little danger of their too frequent appearance on the same field; only the farmer who has gone over to vegetable production on a larger proportion of his land is likely to encounter trouble from this source.

NOTES ON MANURING

Many market gardeners have taken steps to meet the new situation by increasing the size of their holdings, and the increase in some instances has been effected by the absorption of adjacent market-garden land, and in others by taking over new land formerly devoted to agricultural crops either because of its heavier soil or its relative inaccessibility.

Though the production of these commoner vegetables still persists in the older intensive market-garden areas it seems probable that the bulk of this production in the future will be on less intensive lines, on the larger type of holding. The manuring of these crops in an intensive market-garden area is bound up with the problem of maintaining the land in a high state of fertility, suitable for the production of subsequent crops. The farmer who has introduced brassicas such as brussels sprouts, cabbage and cauliflower into his farm rotation, simply as part of the root shift, will be well-advised not to adopt too expensive manurial treatment. His main object will have been achieved if he secures for his land the benefits of a fallow crop without losing money in the process. The term "expensive" manurial treatment is intended to include not merely the quantity of plant nutrients supplied, but also their source. Market gardeners often have a definite preference for heavy dressings of organic fertilizers. To what extent these are of direct benefit to the crop for which they are applied is not certain, though they do maintain the soil in a physical condition specially suitable for the growth of the less easily grown intensive market-garden crops. This latter factor, however, rarely concerns the farmer-grower, and if he uses dung regularly there is no evidence to suggest that he need go outside his usual range of fertilizers in order to grow a vegetable crop.

The market gardener growing brassicas on "new" land not previously market-gardened, will very often be more lavish with his fertilizer applications, especially those supplying nitrogen.

Brussels sprouts, summer and autumn cauliflower, and summer cabbage all respond well to nitrogenous fertilizers, and will usually pay for 3 to 4 cwt. per acre of quick-acting nitrogenous fertilizer, in addition to farmyard manure. The intensive grower frequently uses double this amount of nitrogen, either in the form of artificial fertilizers, soot or organic manures such as shoddy, but the quantity suggested above is a reasonable dressing for the farmer-grower.

NOTES ON MANURING

On some occasions potash and phosphate will also give profitable increases in crop. Phosphate has proved most successful on heavy soils and on fields that have formerly been devoted to agricultural crops. The equivalent of 4 to 6 cwt. per acre of superphosphate is always desirable in such circumstances. Potash, on the other hand, though less generally effective in increasing yield, is said to improve the quality, appearance and flavour of the produce.

Whilst too lavish dressings of fertilizers may fail to give a corresponding improvement in yield or quality of produce, it is certain that good quality produce cannot be grown under conditions of semi-starvation. At the same time it is also worth remembering that no amount of fertilizer or lime will make waterlogged land produce good vegetables. Brussels sprouts are particularly sensitive to wetness and show it both by their stunted growth and poor colour, symptoms that were obvious on parts of many fields in 1936.

Earliness is always an important feature in market-garden crops. All fertilizers tend to produce their greatest effects on yield during the early part of the marketing season, but they do not always actually increase earliness. There is some experimental evidence, however, that, where phosphate and potash give a response in yield, they also give earlier crops.

MANURING OF BRUSSELS SPROUTS

MOST market-garden land contains a good reserve of phosphate from previous fertilizer dressings, but the following photographs of a 32-plot experiment carried out by Mr. J. W. Dallas, in Bedfordshire, show that phosphate may be an important requirement in the manuring of Brussels Sprouts on land not previously market gardened, especially on heavy soils.

The soil was heavy loam and in a low state of fertility, having grown rather poor, extensive, agricultural crops receiving little fertilizer for some years previously.



Between 1st and 2nd sticks

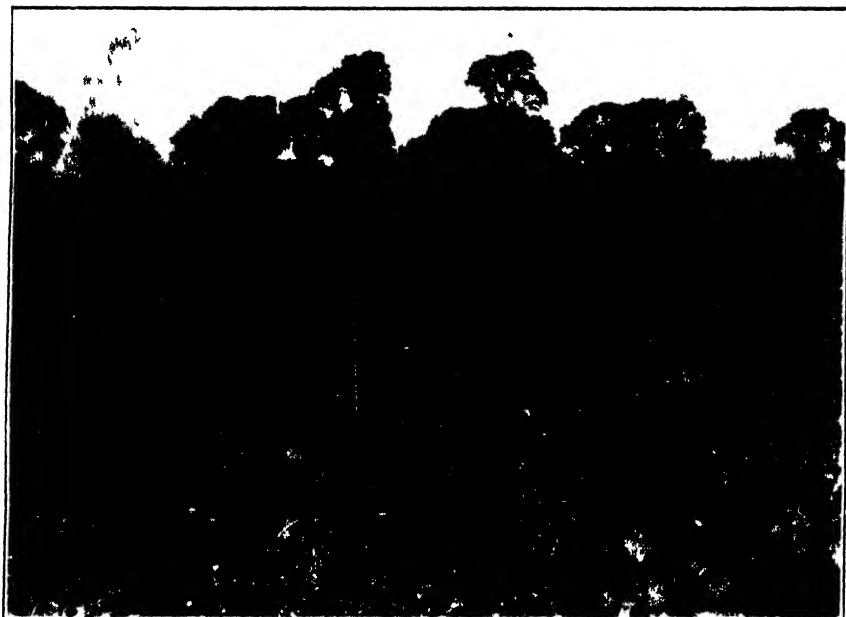
Left, Phosphate only

Right, No manure

Between 2nd and 3rd sticks

Left, Nitrogen and phosphate

Right, Phosphate and potash



between 1st and 2nd sticks

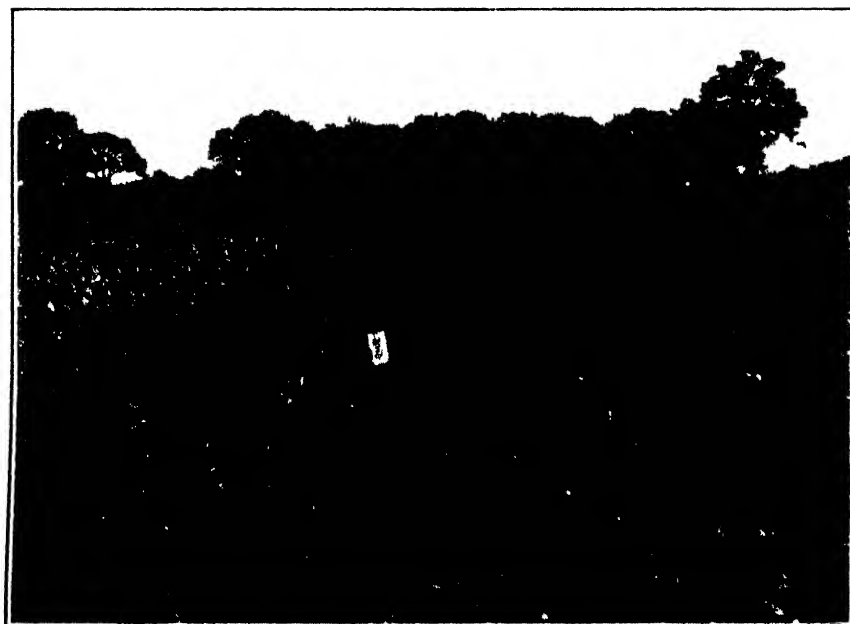
Left Nitrogen and potash.

between 2nd and 3rd sticks

Right Potash only

Left No manure

Right Phosphate and potash



Between 1st and 2nd sticks

Left No manure

Between 2nd and 3rd sticks

Right Nitrogen and potash

Left Phosphate and potash

Right Potash only

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended March 10.				
	Bristol	Hull	L'pool	London	Cost per Unit ¶
Nitrate of Soda (N. 15½%) ..	£ 5. 7 12c	£ 5. 7 12c	£ 5. 7 12c	£ 5. 7 12c	s. d. 9 10
" " Granulated (N. 16%) ..	7 12c	7 12c	7 12c	7 12c	9 6
Nitrate of Lime (N. 13%) ..	7 0c	7 0c	7 0c	7 0c	10 9
Nitro-chalk (N. 15½%) ..	7 5c	7 5c	7 5c	7 5c	9 4
Sulphate of Ammonia:—					
Neutral (N. 20·6%) ..	7 5c	7 5c	7 5c	7 5c	7 0
Calcium Cyanamide (N. 20·6%) ..	7 4d	7 4d	7 4d	7 4d	7 0
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 0	4 17	4 15	4 17	3 3
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%) ..	8 3	8 1	7 17	8 1	3 3
Sulphate " (Pot. 48%) ..	9 15	9 13	9 9	9 13	4 0
Basic Slag (P.A. 15½%) ..	2 12b	2 5b	..	2 10b	3 2
" " (P.A. 14%) ..	2 8b	2 0b	2 0b	2 6b	3 3
Grd. Rock Phosphate (P.A. 26— 27½%) ..	2 12a	2 10a	2 10a	2 5a	1 8
Superphosphate (S.P.A. 16%) ..	3 4	..	3 3e	3 0f	3 9
" " (S.P.A. 13½%) ..	3 1	2 17	2 19e	2 16f	4 1
Bone Meal (N. 3½% P.A. 20½%) ..	..	6 10	7 5g	6 15	..
Steamed Bone Flour (N. ½% P.A. 27½—29½%) ..	5 5h	5 10	5 0g	5 0	..

Abbreviations : N. = Nitrogen ;
S.P.A. = Soluble Phosphoric Acid ;

P.A. = Phosphoric Acid ;
Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 4-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 4 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra, for lots of 10 cwt. and under 1 ton, 15s. extra, and for lots of less than 10 cwt., but not less than 2 cwt., 20s. extra.

e Prices shown are f.o.r. Widnes.

f Prices shown are f.o.r. northern rails; southern rails 1s. 3d. extra.

g Prices shown are f.o.r. Appley Bridge.

h Price shown is f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertiliser, for example, with 16 per cent. nitrogen, contains 16 such "units" in a ton. Then, if the price per ton of such a fertiliser be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Fibre. The precise manner in which the "fibre" of food contributes to its total nutritive effect has long been a subject of controversy, and is still only very imperfectly understood. This is due in part to the fact that the entity denoted as "fibre" is itself ill-defined and apt to vary considerably in chemical nature in different classes of feeding stuffs. To the layman "fibre" is the hard and tough part of food, difficult to masticate and presumed to be more difficult to digest than the rest of the food. When the scheme of analysis that is commonly used for feeding stuffs was first drawn up it was thought desirable, therefore, to include in it an estimation of the proportion of this class of material in the food, and for this purpose the organic matter that remains undissolved after treatment in a prescribed manner with dilute acid and alkali was assumed to represent the "fibre" of the food. For some time this item in the analysis was described as "indigestible fibre," but digestion trials soon demonstrated that "fibre" is to some extent digestible, its digestibility varying greatly, however, with the class of food and its physical condition. There can be no question, therefore, of the fibre figure of a food representing even an approximate measure of the general digestibility of the food, and to-day one prefers to describe this item simply as "fibre" or "crude fibre," without any implications as to indigestibility.

Digestion and Utilization of Fibre. In studying the nutritive significance of "fibre" it must be clearly understood that we are not dealing with a definite chemical compound, nor even a definite group of compounds (as with proteins and oils), but with a variable mixture (mainly of carbohydrates) that is definable only in terms of the particular method of chemical analysis by which its amount is determined. We regard this item, crude though it be, as serving to give us a rough idea of the proportion of hard, tough, difficultly soluble material present in the foodstuff.

Whatever its digestibility, the mastication and passage

NOTES ON FEEDING

through the body of material of this character must involve a considerable expenditure of energy that can only come from the digested part of the food. In many instances this expenditure may exceed the amount of energy provided by the digested part of the fibre, which means that the presence of fibre then tends to reduce rather than to increase the amount of energy available to the animal.

The principal ingredients of "fibre" are cellulose, lignins, and pentosans, but other ingredients are usually present, such as cutins, tannins, pectins, and a small proportion of nitrogenous substance. Of these various ingredients probably cellulose alone has any direct nutrient value, except as a source of heat to the body. That the make-up of the "fibre" with regard to the above ingredients may vary greatly as between different foodstuffs is shown by the examples quoted below:—

PERCENTAGE COMPOSITION OF CRUDE FIBRE.

			<i>Crude Protein</i>	<i>Lignins</i>	<i>Pentosans</i>	<i>Celluloses, etc.</i>
			%	%	%	%
Barley .. ..	..	..	0·6	10·4	15·5	73·5
Oats .. ..	..	..	0·4	10·7	11·2	77·7
Lucerne .. ..	..	..	1·8	45·8	13·3	39·1
Soya Beans .. ..	..	..	0·8	5·8	11·4	82·0

These wide differences in the make-up of the "fibre" complex have a considerable influence upon the extent to which it can be digested and utilized by animals and man.

In contrast to the digestion of proteins, fats, starches, and sugars, which is effected mainly by unorganized ferments (enzymes) present in the digestive juices, the digestion of fibre, in almost all instances where animals eat much vegetable food, is effected mainly through the agency of bacteria. In farm animals the bacterial digestion of fibre in the food plays an important part, both directly through the contribution made by the digested fibre, and indirectly because the attack of the bacteria on the cell walls of the food makes these walls more permeable to the digestive juices, and thus makes more certain that the valuable nutritive contents of the cells will be digested and fully utilized.

On the other hand, the bacterial digestion of fibre involves a certain amount of waste in the form of gases that the animal cannot utilize, but this is probably little more than the similar loss that starch is subject to in the presence of bacteria. This is confirmed by the classical experiments of Kellner in which

NOTES ON FEEDING

digestible straw fibre fed in the form of soft pulp proved as effective as starch for the production of fattening increase in cattle.

Since the digestion of fibre is mainly dependent upon bacterial activity it is to be expected that the power of digesting and utilizing fibre will be most highly developed in the class of animal, namely the ruminant, in whose digestive tract there is the greatest opportunity for bacterial action. The ruminant is, in fact, the only class of animal that can deal at all effectively with the whole range of fibrous foods, from soft greenstuffs to hard straws. In this respect the ruminant is followed at a considerable distance by the horse, but pigs and poultry have little or no power of digesting fibre; even with soft green food their fibre-digesting powers are much below those of the sheep.

The advantage possessed by the ruminant for the digestion of fibre lies in the active bacterial fermentation that takes place in the rumen (paunch). In other animals no appreciable digestion of fibre takes place until the food reaches the caecum and colon, almost at the end of its passage through the body. The amount of fibre digestion effected at this stage is probably small in comparison with that attainable in the rumen.

As regards the pig, the data available for the digestibility of the fibre of individual feeding stuffs show great variation. Thus, results varying from $2\frac{1}{2}$ to 36 per cent. for the digestibility of the fibre in rye meal have been found in different experiments. In the best of these, however, the result has usually been much nearer the lower than the higher of these limits.

With the fowl, the experimental data available are fewer and variable, but the more recent work, such as that of Halnan reviewed in last month's Notes, leaves little doubt that any power possessed by the fowl for digesting the fibre of cereal foods is so small as to be negligible in practice.

The observation has been frequently made in digestion trials that the nature and total amount of the ration in which the fibre is consumed appears to affect the amount of fibre digested. This finds its explanation in the changes in the intestinal flora and in the conditions for the activity of the fibre-digesting bacteria that may accompany changes in the diet. Thus the addition of carbohydrates to the diet of a ruminant will so alter the fermentative balance as to reduce somewhat the digestibility of the fibre.

NOTES ON FEEDING

It might be expected that, especially with the harder food-stuffs, some improvement in digestion of the fibre might be effected by a preliminary grinding of the food, despite the existence of the natural provision for achieving this end by chewing, rumination, etc. The experimental evidence on this point is conflicting, and even where an improvement has been recorded it has usually been small, and attributable in part to imperfect mastication. The same probably applies to the various other methods of preparation (cooking, etc.) designed to soften the fibre.

When improved nutritive results are obtained by special methods of preparation of food the explanation is likely, therefore, to lie only partly in enhanced digestibility, and partly in increased efficiency of utilization of the digested ingredients. That the latter is considerably affected by grinding where coarse fodders are involved was clearly demonstrated by Kellner, and has been repeatedly confirmed elsewhere.

From the foregoing discussion it is obvious that average figures for the digestibility of fibre can have little significance; and in rationing practice, unless digestion trials have been made with the actual material used, one must be guided by its physical nature as to whether one assumes its digestibility to be high, or low, or medium. For this purpose the following data may serve to indicate the range within which the digestibility of the fibre usually falls:—

				<i>Ruminants</i>	<i>Horses</i>	<i>Pigs</i>
				%	%	%
Greenstuffs	..	..	..	40-80	30-70	15-30
Hays	..	..	..	35-65	30-45	—
Straws, chaffs, etc.	..	..	..	30-50	15-30	—
Cereal, grains and legumes	..	..	..	30-80	30-60	20-50
Cakes and meals	..	..	..	30-80	30-60	20-50

Indirect Effects of Fibre. Practical experience supplies abundant evidence that the nutritive effects of a ration often cannot be expressed entirely in terms of the amounts of digestible proteins, oils, carbohydrates, fibre, minerals, and vitamins supplied (see this JOURNAL, Vol. XLIII, No. 7 pp. 682-684), but that certain other factors that are less easily defined also come into play and determine whether the ration will, or will not "suit" the animal. The characteristics that determine palatability furnish one example of such factors, whilst another to which the practical feeder attaches importance is the density or "bulkiness" of the feed. With

NOTES ON FEEDING

the root crops the quality of bulkiness arises mainly from their high water-content, but in all other foods it is closely associated with the amount and nature of the fibre present in the food. A high fibre-content usually connotes bulkiness and a low fibre-content compactness.

We have seen that at best fibre does not rank high as a source of digested nutriment, and yet an increase in the proportion of fibrous food in a ration at the expense of more digestible ingredients will frequently effect a substantial improvement in nutritive results. In such instances it is clear that the fibre has not acted through its direct contribution to the total supply of digested nutrients, which is in fact reduced by the change in the ration, but that in some way the increase of the fibrous ingredient has made it possible for the animal to use the digested nutrients with greater efficiency. It may possibly be a matter of securing optimum conditions as to the volume-loading of the digestive organs, or alternatively the explanation may lie in a more powerful mechanical stimulus to the muscles of the organs through the greater quantity of indigestible "ballast" with which they have to deal in the more fibrous ration. It seems possible also that with some foods the effect is not entirely associated with the fibre, but is in part specific to the food; this is strongly suspected to be true of bran, but has not been clearly proved.

In so far as the effects are due to fibre they must obviously depend upon the nature of the ration to which the fibrous food is added. If it is too "compact" the addition may be expected to be beneficial, whereas if it is already sufficiently bulky, or if anything too bulky, any further addition of fibrous food must inevitably cause a falling-off in nutritive effect. It is not surprising, therefore, that practical experience with such foods should vary more than with the less fibrous feeding stuffs.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British.. ..	9 0	0 8	8 12	72	2 5	1.29	9.6
Barley, British feeding ..	8 10	0 8	8 2	71	2 3	1.20	6.2
" Argentine ..	9 0	0 8	8 12	71	2 5	1.29	6.2
" Persian ..	7 13*	0 8	7 5	71	2 1	1.12	6.2
" Polish ..	8 10½	0 8	8 2	71	2 3	1.20	6.2
Oats, English, white ..	8 13	0 9	8 4	60	2 9	1.47	7.6
" " black and " " grey ..	8 13	0 9	8 4	60	2 9	1.47	7.6
" Scotch, white ..	9 13	0 9	9 4	60	3 1	1.65	7.6
" Canadian, mixed " " feed ..	7 15	0 9	7 6	60	2 5	1.29	7.6
Maize, Argentine ..	6 0	0 7	5 13	78	1 5	0.76	7.6
" Danubian Gal.Fox	6 8†	0 7	6 1	78	1 7	0.85	7.6
" South African, " No. 3 White Flat	6 18†	0 7	6 11	78	1 8	0.89	7.6
Beans, English, Winter	6 15½	0 17	5 18	66	1 9	0.94	19.7
Peas, English Blue ..	11 5½	0 14	10 11	69	3 1	1.65	18.1
" Japanese.. ..	25 13†	0 14	24 19	69	7 3	3.88	18.1
Dari	8 5†	0 8	7 17	74	2 1	1.12	7.2
Milling Offals :—							
Bran, British ..	7 7	0 15	6 12	43	3 1	1.65	9.9
" " broad ..	7 12	0 15	6 17	43	3 2	1.70	10
Weatings† ..	7 10	0 14	6 16	56	2 5	1.29	10.7
" Superfine† ..	8 0	0 13	7 7	69	2 2	1.16	12.1
Pollards, imported ..	7 2	0 14	6 8	50	2 7	1.38	11
Meal, barley ..	9 12	0 8	9 4	71	2 7	1.38	6.2
" " grade II ..	8 17	0 8	8 9	71	2 5	1.29	6.2
" maize ..	6 12	0 7	6 5	78	1 7	0.85	7.6
" " germ ..	6 15	0 11	6 4	84	1 6	0.80	10.3
" locust bean ..	7 15	0 5	7 10	71	2 1	1.12	3.6
" bean ..	8 10	0 17	7 13	66	2 4	1.25	19.7
" fish (white) ..	14 15	2 2	12 13	59	4 3	2.28	53
Maize, cooked, flaked..	7 4	0 7	6 17	84	1 8	0.89	9.2
" gluten feed ..	7 0	0 13	6 7	76	1 8	0.89	19.2
Linseed cake—							
English, 12% oil ..	10 2	1 0	9 2	74	2 6	1.34	24.6
" 9% " ..	9 10	1 0	8 10	74	2 4	1.25	24.6
" 8% " ..	9 5	1 0	8 5	74	2 3	1.20	24.6
Cottonseed cake,							
English, Egyptian seed, 4½% oil ..	5 17	0 18	4 19	42	2 4	1.25	17.3
Cottonseed cake, Egyptian 4½% oil ..	5 2	0 18	4 4	42	2 0	1.07	17.3
Cottonseed cake, decorticated, 7% oil ..	8 17†	1 8	7 9	68	2 2	1.16	34.7
Cottonseed meal, decorticated, 7% oil ..	8 17†	1 8	7 9	70	2 2	1.16	36.8
Coconut cake, 6% oil ..	7 5	0 18	6 7	77	1 8	0.89	16.4
Ground-nut cake, decorticated, 6-7% oil	7 17†	1 8	6 9	73	1 9	0.94	41.3

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Ground-nut cake, im- ported decorticated, 6-7% oil ..	8 5	1 8	6 17	73	1 11	1·03	41·3
Palm kernel meal, 1-2% oil ..	7 0	0 12	6 8	71	1 10	0·98	16·5
Feeding treacle ..	5 0	0 8	4 12	51	1 10	0·98	2·7
Brewers' grains, dried ale ..	6 7	0 11	5 16	48	2 5	1·29	12·5
Brewers' grains, dried porter ..	6 0	0 11	5 9	48	2 3	1·20	12·5
Dried sugar-beet pulp..	From £5 7s. 6d. to £5 17s. 6d. per ton ex-factory (according to factory.)						

* At Bristol.

§ At Hull.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE: The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex-mill or store. The prices were current at the beginning of March, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 per ton as shown above, the cost of food value per ton is £10. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1·43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 2d.; P₂O₅, 2s. 3d.; K₂O, 3s. 6d.

FARM VALUES OF FEEDING STUFFS ... ..	89

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6·2	8 8
Maize	78	7·6	6 0
Decorticated ground-nut cake ..	73	41·3	8 1
„ cotton-seed cake ..	68	34·7	8 17
(Add 10s. per ton, in each instance, for carriage.)			

The cost per unit starch equivalent works out at 1·97 shillings, and per unit protein equivalent 1·06 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The Table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816).

FARM VALUES.

Crop	Starch equivalent	Protein equivalent	Food Value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	7 12
Oats	60	7·6	6 6
Barley	71	6·2	7 6
Potatoes	18	0·8	1 16
Swedes	7	0·7	0 15
Mangolds	7	0·4	0 14
Beans	66	19·7	7 11
Good meadow hay ..	37	4·6	3 18
Good oat straw ..	20	0·9	2 0
Good clover hay ..	38	7·0	4 2
Vetch and oat silage ..	13	1·6	1 7
Barley straw ..	23	0·7	2 6
Wheat straw ..	13	0·1	1 6
Bean straw ..	23	1·7	2 7

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d., post free 7d.

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The Agricultural Index Number

THE general index number of prices of agricultural produce for February is 129 (base 1911-13=100), 1 point lower than in the preceding month, but 11 points above that of a year ago. (If allowance be made for payments under the Wheat Act, 1932, and the Cattle Industry (Emergency Provisions) Act, 1934, the revised index is 133.) Compared with January, higher prices were realized for oats, fat cattle and sheep, eggs, poultry, cheese and wool, while wheat, porkers, and potatoes made less money. Barley, baconers, butter, and milk were unchanged in price.

Monthly index numbers of prices of Agricultural Produce. (Corresponding months of 1911-13 = 100.)

Month	1932	1933	1934	1935	1936	1937
January .. .	122	107	114	117	119	130
February .. .	117	106	112	115	118	129
March .. .	113	102	108	112	116	—
April .. .	117	105	111	119	123	—
May .. .	115	102	112	111	115	—
June .. .	111	100	110	111	116	—
July .. .	106	101	114	114	117	—
August .. .	105	105	119	113	119	—
September .. .	104	107	119	120	127	—
October .. .	100	107	114	113	125	—
November .. .	101	109	114	113	125	—
December .. .	103	110	113	114	126	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and the Cattle Industry (Emergency Provisions) Act (b).

Month	1932	1933	1934	1935	1936	1937
January .. .	—	111	119	124	125	133
February .. .	—	110	117	122	123	133
March .. .	—	106	112	118	122	—
April .. .	—	109	116	126	128	—
May .. .	—	105	116	117	120	—
June .. .	—	104	114	117	121	—
July .. .	—	104	117	120	121	—
August .. .	108	108	122	120	124	—
September .. .	108	111	125	128	133	—
October .. .	104	112	121	119	129	—
November .. .	105	113	120	119	129	—
December .. .	107	114	120	120	130	—

(a) Commenced August, 1932.

(b) Commenced September, 1934.

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Grain. At an average of 9s. 1d. per cwt., wheat was 8d. lower than in January, and as a consequence the index declines from 133 to 122. (If the "deficiency payment" under the Wheat Act, 1932, is taken into account the figure becomes 133.) Barley at 10s. per cwt. showed no alteration in price, but, owing to a slight rise in the base years, the index falls by 1 point to 124. Oats averaged 8s. 3d. per cwt. against 8s. 2d. in January, but, as a more pronounced rise occurred in the base period, the index is reduced from 120 to 116. A year ago wheat averaged 6s. 4d., barley 7s. 11d., and oats 6s. per cwt., the indices being 85, 98, and 85 respectively.

Live Stock. Fat cattle, at an average of 34s. 3d. per live cwt. for second quality, again showed an advance, the average for January being 33s. 1d., and the index rises by 2 points to 99. (With the addition of the subsidy under the Cattle Industry (Emergency Provisions) Act, 1934, the index becomes 114.) At an average of 11d. per lb. for second quality the price of fat sheep appreciated by $\frac{1}{2}$ d.; on account, however, of a proportionately greater increase having occurred during the corresponding months of 1911-13, the index falls from 140 to 137. Baconers at 12s. 4d. per score (20 lb.) maintained last month's quotations, but porkers at 13s. 3d. were lower in price by 3d. As a result of a rise during the base period, the relative indices at 126 and 125 are lower by 4 and 6 points.

Dairy cows were unaltered both in price and index. Store cattle and sheep were dearer; the index for the former appreciates by 2 points to 101, but that for sheep at 115 moves downwards by 3 points. Store pigs were slightly cheaper and the index is reduced from 152 to 139.

Dairy and Poultry Produce. During the month under review the regional contract price of liquid milk was unchanged, the index again standing at 171. Butter at 1s. 2d. per lb. showed no alteration in price, but the index rose by 2 points to 97, owing to a slight fall in the base prices. At an average of 13s. 1d. per 120, eggs showed a rise on the month of 10d., and the index moves upwards from 95 to 115. Quotations for cheese also were higher, the average for February at 80s. per cwt. being 2s. more than in January; with a similar increase in the base period, the index remains at 107. Higher prices were realized for all classes of poultry, and the combined index rises by 1 point to 121.

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Other Commodities. At £7 15s. per ton, potatoes were lower by 1s. 6d., the index declining from 205 to 201. Both descriptions of hay were a little firmer in price, but not enough to alter the combined index of 98. Wool at 1s. 4½d. per lb. sold at ½d. above the January price, but the index at 131 is the same owing to the influence of the base prices.

Monthly index numbers of prices of Individual Commodities. (Corresponding months of 1911-13 = 100)

Commodity	1935	1936			1937	
	Feb.	Feb.	Nov.	Dec.	Jan.	Feb.
Wheat ..	63	85	114	118	133	122
Barley ..	101	98	115	115	125	124
Oats ..	99	85	98	101	120	116
Fat cattle ..	91	96	93	91	97	99
„ sheep ..	134	119	130	128	140	137
Bacon pigs	120	111	118	124	130	126
Pork ..	125	114	126	131	131	125
Eggs ..	96	118	111	106	95	115
Poultry	124	122	116	119	120	121
Milk ..	171	171	171	171	171	171
Butter	86	93	97	98	95	97
Cheese	94	95	107	103	107	107
Potatoes	116	200	209	220	205	201
Hay	102	83	102	98	98	98
Wool	87	96	107	118	131	131
Dairy cows	102	103	109	111	111	111
Store cattle	84	92	95	98	99	101
„ sheep	109	104	117	113	118	115
„ pigs ..	142	129	155	156	152	139

Revised index numbers due to payments under the Wheat Act and the Cattle Industry (Emergency Provisions) Act.

Wheat ..	117	122*	131	134	134	133
Fat cattle ..	105	110	108	105	112	114
General Index ..	122	123	129	130	133	133

* Superseding figure previously published.

Potato Synonyms

THE following note has been communicated by the National Institute of Agricultural Botany:—

The report on the work of the Potato Synonym Committee of the National Institute of Agricultural Botany during 1936 forms a striking contrast with those issued in the early years of the Committee's activities. Whereas in former years a considerable proportion of varieties examined proved to be

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no more than established varieties under new names, in 1936 all but two were found to be distinct.

A great reduction is also recorded in the number of synonyms which continue to be offered in seedsmen's catalogues. The improvement in this respect has been continuous, and as a result of direct correspondence, with few exceptions, seedsmen throughout the country now intend to list varieties only under their established names. No satisfactory replies, however, have been received in respect of Cherub, Early Favourite, and Cleadon Park, and it should be pointed out that these are identical with Duke of York, Sharpe's Express, and King Edward VII (red type) respectively. Apart from these, Midlothian Early and Sir John Llewellyn are still to be found in some catalogues. It is to be hoped that seedsmen will make it clear that these are identical with Duke of York and Eclipse, for the duplication of names can only lead to confusion.

At one time the work of the Committee was not generally appreciated, but we can say to-day that seed growers and buyers alike recognize the value of the efforts made to protect their interests by reducing the many names under which potatoes have, in the past, been sold.

Copies of the report for 1936 may be obtained on application to the Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge.

Importation of Chrysanthemums

WITH the object of preventing the introduction, through the medium of imported plants, of the Chrysanthemum Midge (*Diarthronomyia hypogæa* F. Löw), which has proved a serious pest of greenhouse Chrysanthemums in North America, the Minister has made an Order* under the Destructive Insects and Pests Acts, 1877 to 1927, prohibiting, as from April 12, 1937, the landing in England or Wales from any country other than Scotland, Northern Ireland, the Irish Free State, the Isle of Man, or the Channel Islands of any living Chrysanthemum plant and parts thereof (except seeds) for planting, except under licence. The Order, which is entitled The Importation of Plants (Amendment) Order of

* Copies of the Order (S R. and O., 1937 No 197) may be obtained either directly, or through any bookseller, from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 1d. net, postage extra.

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1937, also prescribes that the Health Certificates required under the Importation of Plants Order of 1933 to accompany imported plants must include a statement that the consignment does not contain any Chrysanthemum plant.

The Ministry will be prepared to entertain applications for licences under the Order submitted by importers who are in a position to comply with the conditions which will be incorporated in the licences. These conditions will, *inter alia*, require the imported plants to be kept isolated from other Chrysanthemums in a separate greenhouse and to be examined from time to time by one of the Ministry's Inspectors until all danger of the appearance of Chrysanthemum Midge is past. Occasional spraying with a nicotine wash may also be required.

An illustrated article on the Chrysanthemum Midge appeared in the March, 1937, issue of this JOURNAL (pp. 1158-1161).

Sheep Scab Prosecution

ON February 12, at the Sheriff Court, Duns, Berwickshire, proceedings were taken against a farmer for offences against the Sheep Scab Order of 1928 and the Movement of Animals (Records) Order of 1925. An Inspector of the Ministry who visited the farm on January 29, in connexion with the tracing of animals moved from other infected premises, found eight sheep out of a total stock of 40 sheep to be affected with sheep scab, while the carcass of a sheep that was exhumed was found to be almost denuded of wool and very badly affected with scab. Sheep from these premises had been in contact with neighbouring animals, one of which was found to be affected. The farmer pleaded guilty and a fine of £100 was imposed by the Sheriff who referred to the case as one of gross carelessness. The steps taken by the Ministry in co-operation with Local Authorities during recent years to eradicate sheep scab have been attended with considerable success, but further progress may be seriously hindered if farmers in certain localities fail to co-operate by reporting suspected cases promptly. It is hoped that the penalty imposed in this instance may have a salutary effect and that sheep owners will realize the necessity of observing the requirements of the Sheep Scab Order so that the efforts now being made to free the flocks in Great Britain from disease may be effective.

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Advisory Leaflets

SINCE the date of the list published in the January, 1937, issue of this JOURNAL (p. 1005), the undermentioned Advisory Leaflets have been issued by the Ministry:—

- No. 84.—The Pear and Cherry Sawfly (Revised).
- No. 90.—Essential Points in Poultry Feeding (Rewritten).
- No. 151.—The Cultivation of Parsnips (Revised).
- No. 187.—Woolly Aphis (Revised).
- No. 277.—"Reversion" in Black Currants.
- No. 279.—Skin Spot and Silver Scurf of Potatoes.
- No. 280.—Ragwort.

Copies of any of the above-mentioned leaflets may be purchased from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or at the Sale Offices of that Department at Edinburgh, Manchester, Cardiff, and Belfast, price 1*d.* each net (1½*d.* post free), or 9*d.* net per doz. (10*d.* post free).

Single copies of not more than 20 leaflets may, however, be obtained, free of charge, on application to the Ministry. Further copies beyond this limit must be purchased from H.M. Stationery Office, as above.

A list of the Ministry's publications, including leaflets, on agriculture and horticulture may be obtained free and post free on application to the Ministry.

Post Graduate Agricultural Scholarships and Refresher Course Grants

THE Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland invite applications for (1) agricultural scholarships from students who propose to follow the career of agricultural organizer or instructor or lecturer in agriculture (including horticulture, dairying, and poultry-husbandry), and (2) for grants for refresher courses from agricultural organizers, instructors, and lecturers already employed on the staffs of county agricultural educational authorities in England and Wales and from county organizers and instructresses on the staffs of the Agricultural Colleges in Scotland. The selection from candidates will be by interview, and the allocation of the scholarships and grants between the applicants from England, Wales and Scotland will be made entirely on the basis of merit.

AGRICULTURAL SCHOLARSHIPS. The object of the scholarships, of which not more than 4 will be awarded annually,

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is to broaden the agricultural knowledge and experience of students and so to qualify them for the position of agricultural organizer, instructor, or lecturer.

Candidates must be British born, and should be graduates of a University, but exceptional candidates, otherwise qualified, who have not had an opportunity of graduating, will be regarded as eligible. Application may also be made in respect of candidates who have sat for a Degree or Diploma examination of which the result has not been announced. In addition, candidates should have had some experience of practical farming.

The value of the scholarships will not exceed £200 together with an allowance for approved fees and travelling expenses. The amount may be varied in accordance with the scholar's means and may cover the whole of the cost of training, including maintenance, or a proportion only of such cost.

The period of the scholarships is normally one year and commences on October 1. It will be spent at such agricultural educational or research institutions, advisory centres or farms as the Ministry or the Department may direct.

Candidates must be nominated by a Professor, Principal or Lecturer of a University or College on the prescribed form and the nomination must be received not later than June 15. Students in England and Wales should submit their nominations to the Ministry of Agriculture and Fisheries and students in Scotland to the Department of Agriculture for Scotland.

REFRESHER COURSE GRANTS. The purpose of the refresher course grants is to provide means and opportunity for those already engaged in agricultural educational work to widen their knowledge of particular branches of agriculture and to become acquainted with recent advances on the scientific side of the subject. Special courses will be arranged to suit the particular circumstances of successful applicants. Applications for grants for this purpose must be made on the prescribed form to the Ministry or the Department, and must be approved by the Authority or the governing body of the College by whom the applicant is employed and by whom the salary of the applicant would be payable during the period of the course.

The period of a course will normally be about 4 weeks, and in any instance will not exceed 8 weeks, and will be spent at such agricultural educational or research institutions, advisory centres or farms as the Ministry or the Department

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may direct. Reasonable travelling and subsistence expenses and any fees incurred by a successful applicant in taking a course will be defrayed.

Forms of application for both the agricultural scholarships and the refresher course grants and all other particulars may be obtained, by English and Welsh students, from the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1, and, by Scottish students, from the Secretary, Department of Agriculture for Scotland, 29, St. Andrew Square, Edinburgh, 2. The latest date for receiving applications is June 15, 1937.

Stud Goat Scheme, 1937-38

THIS scheme for the improvement of milch goats kept by cottagers, smallholders and others is being continued during the forthcoming breeding season, which extends from September 1 to February 28 next. Under this scheme persons in the above-named categories are enabled to procure the services of first-class stud goats for breeding purposes at a maximum fee of 4s. per service. The stud goats used must have been entered, or be considered eligible for entry, in the British Goat Society's Herd Book, and they must have been bred from milk-producing stock. As in previous years, the scheme will be administered by the Society, and owners desirous of having their stud goats registered are requested to make application to the Secretary, Roydon Road, Diss, Norfolk, not later than April 15. No application will be considered after May 20, and goats submitted for approval must be available after that date for inspection at the premises at which they are intended to stand at stud. It is interesting to note that Tamarisk*, a smallholder's goat whose sire and grandsire were registered under the scheme, won her star at the New Forest Agricultural Show last summer with a one-day yield of 17 lb.

Farm Workers' Minimum Rates of Wages.—A meeting of the Agricultural Wages Board was held at Kings Buildings, Smith Square, London, S.W.1, on Tuesday, March 16, 1937, Mr W. B. Yates, C.B.E., J.P., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following orders :—

Devonshire.—An Order fixing minimum and overtime rates of wages to come into operation on March 21, 1937 (i.e., the day following that on which existing rates are due to expire), and to continue in force until March 26, 1938. The minimum rates for male workers of 21 years of

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age and over are 34s. (instead of 32s. 6d. as at present) per week of 50 hours in winter, except in the weeks in which Good Friday, Easter Monday, Christmas Day and December 27, 1937, fall when the hours are 41, and 52 hours in summer, except in the week in which Whit Monday falls when the hours are 43, with overtime unchanged throughout the period at 8½d. per hour on weekdays and 10d. per hour on Sundays and for overtime employment on the hay and corn harvests. The minimum rates for female workers of 18 years of age and over are unchanged at 6d. per hour for a week of 48 hours, except in the weeks in which Good Friday, Easter Monday, Whit Monday, Christmas Day and December 27, 1937, fall when the hours are 40, with overtime at 7½d. per hour as at present.

Essex.—An Order fixing minimum and overtime rates of wages to come into force on March 28, 1937 (i.e., the day following that on which the existing rates are due to expire), and to continue in operation until April 2, 1938. The minimum rates for male workers of 21 years of age and over are 32s. 6d. (instead of 31s. 6d. as at present) per week of 50 hours in summer, except in the weeks in which Easter Monday and Whit Monday fall when the hours are 41½, and 48 hours in winter, except (i) in the week in which Christmas Day and Boxing Day fall together, when the hours are 31, and (ii) in the weeks in which Christmas Day and Boxing Day fall, when those days fall in separate weeks, when the hours are 39½, with overtime at 9½d. per hour on weekdays (including Easter Monday, Whit Monday and Boxing Day), and 10½d. per hour on Sundays and on Christmas Day (instead of 9½d. and 10½d. per hour respectively as at present). The minimum rate for female workers of 21 years of age and over remains unchanged at 6½d. per hour for all time worked.

Herefordshire.—An Order fixing minimum and overtime rates of wages to come into force on May 1, 1937 (i.e., the day following that on which existing rates are due to expire), and to continue in operation until April 30, 1938. The minimum rates are (i) in the case of male workers of 21 years of age and over employed wholly or mainly as bailiffs, waggoners, stockmen, or shepherds, 37s. (instead of 36s. as at present) per week (including Sunday) for all time necessarily spent on the immediate care of animals (not exceeding 60 hours) with overtime unchanged at 9d. per hour, except for employment on Christmas Day and Good Friday where a worker has completed less than 60 hours in the weeks in which those holidays fall, when the rate is 2d. per hour; (ii) for other male workers of 21 years of age and over, 32s. 6d. (instead of 31s. 6d. as at present) per week of 48 hours in winter, except in the week in which Christmas Day falls when the hours are 39½, and 54 hours in summer, except in the week in which Good Friday falls when the hours are 44½, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays (as at present); and (iii) for female workers of 18 years of age and over, 5d. per hour (as at present), with overtime at 6d. per hour, except for employment on Christmas Day and Good Friday where a whole-time worker has completed less than 46½ hours in the weeks in which those holidays fall, when the rate is 1½d. per hour.

Kent.—An Order fixing minimum and overtime rates of wages to come into force on March 28, 1937 (i.e., the day following that on which existing rates are due to expire), and to continue in operation until April 2, 1938. The minimum rates for male workers of 21 years of age and over employed wholly or mainly as horsemen, stockmen or shepherds are 35s. (instead of 33s. 6d. as at present) per week of 52 hours, except (i) in the weeks in which Easter Monday and Coronation Day fall when the hours are 42½, (ii) in the week in which Christmas Day

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and Boxing Day fall together when the hours are 33, and (iii) in the weeks in which Christmas Day and Boxing Day fall when those days fall in separate weeks, when the hours are 42½. The minimum rates for other male workers of 21 years of age and over are 34s. (instead of 33s. as at present) per week of 52 hours in summer, except in the weeks in which Easter Monday and Coronation Day fall when the hours are 42½, and 48 hours in winter, except (i) in the week in which Christmas Day and Boxing Day fall together when the hours are 31 (instead of 30 hours as formerly), and (ii) in the weeks in which Christmas Day and Boxing Day fall, when these days fall in separate weeks, when the hours are 39½. The overtime rates are, in the case of ordinary male workers of 21 years of age and over, 9d. per hour on weekdays and 10d. per hour on Sundays, Easter Monday, Christmas Day and Boxing Day (as formerly) and 10d. per hour on Coronation Day, and in the case of horsemen, stockmen or shepherds of similar age 10d. per hour on Easter Monday, Coronation Day, Christmas Day and Boxing Day and 9d. per hour for all other overtime employment (including Sundays). The minimum rate for female workers of 18 years of age and over is unchanged at 6d. per hour, with overtime at 6½d. per hour on weekdays and 7d. per hour on Sundays, Easter Monday, Christmas Day and Boxing Day (as at present) and 7d. per hour on Coronation Day.

Lincolnshire (Holland).—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor to come into force on March 28, 1937, and to continue in operation until October 30, 1937. The minimum rates for male workers of 21 years of age and over are 35s. (as at present) per week of 50 hours in summer except in the weeks in which Coronation Day, Whit Monday and August Bank Holiday fall when the hours are 41. In the case of horsemen, cattlemen and shepherds of similar age additional weekly sums are fixed to cover all time worked in excess of the number of hours mentioned above, except employment which is to be treated as overtime employment. The overtime rates for male workers of 21 years of age and over are 1s. 1½d. per hour on Sundays (as at present), 9d. per hour (instead of 8½d. as at present) on Whit Monday and August Bank Holiday, 9d. per hour on Coronation Day, 10½d. per hour on Saturday or other weekly short day (as at present) and 10½d. per hour (instead of 9d. as at present) for all other overtime employment. The minimum rate for female workers of 15 years of age and over is 6d. per hour, except in Coronation Week when the minimum rate is 7d. per hour, with overtime at 7d. per hour for all employment in excess of 5½ hours on Saturday or other agreed weekly short day, on Sundays and in excess of 8 hours on any day.

Northumberland.—An Order fixing minimum and overtime rates of wages to come into force at noon on May 13, 1937 (i.e., when the existing rates are due to expire), and to continue in force until noon on May 13, 1938. The minimum rates for male workers of 21 years of age and over employed as stewards, horsemen, cattlemen, stockmen, or shepherds and hired by the week or longer period are 39s. 6d. (instead of 38s. 6d. as at present) in the case of workers who are householders, and 36s. 6d. (instead of 35s. 6d. as at present) in the case of workers who are not householders, per week of customary hours (not exceeding 62). For other male workers of 21 years of age and over (except workers in casual employment) the minimum rate is 32s. 6d. (instead of 31s. 6d. as at present) per week of 48 hours in winter and 52½ hours in summer, overtime being payable in the case of all regular male workers at not less than 9d. per hour on weekdays and 11d. per hour on Sundays. The minimum rate for casual male workers of 18 years of age and over is 8d. per hour

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(instead of 7d. per hour as at present) for all time worked. The minimum rates for female workers of 18 years of age and over are 6d. per hour (instead of 5d. per hour as at present) in the case of regular workers, and 4d. per hour (instead of 3d. per hour as at present) in the case of casual workers, with overtime at 7d. per hour and 5d. per hour respectively (instead of 6d. per hour and 4d. per hour as at present).

Somerset.—An Order fixing minimum and overtime rates of wages to come into force on March 28, 1937 (i.e., the day following that on which the existing rates are due to expire) and to continue in operation until March 26, 1938. The minimum rates for male workers of 21 years of age and over are 34s. (instead of 32s. 6d. as at present) per week of 52 hours in summer, except in the weeks in which Easter Monday, Coronation Day, Whit Monday and August Bank Holiday fall when the hours are 42½, and 50 hours in winter, except in the weeks in which Christmas Day and December 27, 1937 fall when the hours are 41½, with overtime unchanged at 9d. per hour, except for overtime employment on the hay and corn harvests when the rate is 10d. per hour. Provision is made for adjustment of the hours in respect of which the minimum weekly wage is payable in the weeks in which Easter Monday, Coronation Day, Whit Monday, August Bank Holiday, Christmas Day, and December 27, 1937, fall, to meet cases where alternative holidays are given within 14 days of such holidays. The minimum rate for female workers of 21 years of age and over is unchanged at 6d. per hour for all time worked.

Sussex.—An Order fixing minimum and overtime rates of wages to come into force on March 22, 1937 (i.e., the day following that on which the existing rates are due to expire) and to continue in operation until July 11, 1937. The minimum rates in the case of male workers of 21 years of age and over are (i) for workers employed wholly or mainly as horsemen, cowmen, stockmen, or shepherds, 37s. 6d. (as at present) per week of 58 hours except in the weeks in which Good Friday, Coronation Day and Whit Monday fall when the hours are 50; and (ii) for other workers, 32s. 6d. (as at present) per week of 52 hours, except in the weeks in which Good Friday, Coronation Day and Whit Monday fall when the hours are 44. The overtime rates for all classes of adult male workers are unchanged at 9d. per hour on weekdays, and 10d. per hour on Sundays. The minimum rate for female workers of 18 years of age and over is 5d. per hour, with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays (as at present).

Wiltshire.—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor, to come into force on March 25, 1937, and to continue in operation until January 1, 1938. The minimum rates for male workers of 21 years of age and over are 32s. 6d. (instead of 31s. as at present) per week of 50 hours, except in the weeks in which Good Friday, Easter Monday, Coronation Day, Whit Monday, August Bank Holiday, Christmas Day, and December 27, 1937, fall when the hours are 41. The overtime rates are 9½d. per hour on weekdays (instead of 9d. as at present) and 10d. per hour on Sundays, Good Friday, Easter Monday, Coronation Day, Whit Monday and Christmas Day (as at present) and 10d. per hour on August Bank Holiday and December 27, 1937. The rate for overtime employment on the hay and corn harvests on weekdays is 9½d. per hour (instead of 9d. as at present). The minimum rate for female workers of 18 years of age and over is 5d. per hour for all time worked (as at present).

Radnor and Brecon.—An Order fixing minimum and overtime rates of wages to come into force on May 1, 1937 (i.e., the day following that on which the existing rates are due to expire) and to continue in operation until

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October 31, 1937. The minimum rates for male workers of 21 years of age and over are 32s. (instead of 31s. as at present) per week of 50 hours in winter and 54 hours in summer, with overtime unchanged at 9d. per hour. For female workers of 18 years of age and over, the minimum rate is unchanged at 5d. per hour with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays (as at present).

Enforcement of Minimum Rates of Wages.—During the month ending March 13, 1937, legal proceedings were taken against fourteen employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow :—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers involved
		£ s. d.	£ s. d.	£ s. d.	
Berkshire ..	Wantage	0 10 0	1 3 6	3 11 0	1
Do. ..	Do.	*	—	27 0 0	1
Cheshire ..	Macclesfield	2 0 0	3 9 0	19 15 0	2
Lancashire	Radcliffe	12 0 0	4 6 8	60 13 4	2
Nottinghamshire ..	Workshop	2 0 0	0 10 6	49 1 2	2
Do. ..	Do. ..	0 10 0	0 5 0	8 8 0	1
Shropshire	Baschurch	10 0 0	0 10 0	47 10 0	4
Somerset ..	Axbridge..	3 0 0	0 12 6	34 16 11	1
Westmoreland ..	Appleby ..	†	—	—	3
Yorkshire (E R)	Filey ..	7 10 0	2 12 6	12 3 2	1
Do. ..	Bridlington	2 0 0	0 5 0	15 7 0	1
Carmarthen	Llanfihangel	0 5 0	—	14 11 4	1
Carnarvon	Pwllheli ..	1 0 0	—	0 15 0	1
Do. .	Carnarvon	1 0 0	0 5 0	27 11 5	1
		41 15 0	13 19 8	321 3 4	22

* Dismissed under " Probation of Offenders " Act. .

† Dismissed.

Foot-and-Mouth Disease.—No outbreak of Foot-and-Mouth Disease has been confirmed since February 5. At the time this issue of the JOURNAL went to press, no part of Great Britain was subject to any restriction in connexion with this disease.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Essex : Miss D. O. Ashton, B.Sc., N.D.H., has been appointed Instructress in Rural Domestic Science, *vice* Miss E. W. Jameson, N.D.H.

Lincolnshire (Lindsey) : Mr. A. Mann, B.Sc., has been appointed Agricultural Organizer, *vice* Mr. A. McVicar, B.Sc., N.D.A., N.D.D., who resigned on March 31 to take up a similar appointment in Shropshire.

Norfolk : Mr. P. E. Cross, N.D.H., has been appointed Assistant Director of Horticultural Education, and will take up his duties on May 1.

WIRELESS TALKS TO FARMERS, APRIL, 1937

<i>Station and Date</i>	<i>Time : p.m</i>	<i>Speakers</i>	<i>Subject</i>
National : April 5, 12, 19, 26	6.20	Mr. J. G. Stewart	—
Midland : April 1	6.40	Messrs. W. B. Thompson and W. Milner	Shire Horses.
.. 3	8.30	Our Country Correspondent: Captain H. A. Gilbert	Wild Fowl Inquiry.
.. 11	8.45	Mr Robin Whitworth	Vale of Evesham Fruit-growing.
.. 15	6.40	---	For Midland Farmers
West : April 1	6.50	Fortnightly Letter	For Western Farmers.
.. 8	6.40	Messrs. A. W. Ling and B. J. Fricker	What is Going on in Gloucestershire.
.. 15	6.50	Fortnightly Letter	For Western Farmers.
.. 22	6.40	Messrs. A. W. Ling and B. J. Fricker	What is Going on in Cornwall.
.. 29	6.50	Fortnightly Letter	For Western Farmers.
North : April 9	6.10	Messrs. J. J. Green, G. M. Robertson and J. L. Moorhouse	Poultry Farming in Lancashire.
.. 22	6.20	Prof J. A. Hanley and Mr E. Wylie Fenton	Land Utilization.
Welsh : April 2	7.30	Mr Moses Griffith (in Welsh)	For Welsh Farmers: The Farming Situation in Wales To-day.
.. 6	7.45	Mr. W. H. Jones (in Welsh)	For Welsh Farmers: Introductory to a new series of talks
Scottish : April 1	6.40	Dr. J. Russell Greig	For Scottish Farmers
.. 7	6.30	Dr. Allan Fraser	For Scottish Farmers
.. 15	6.20	Principal W. G. R. Paterson	Bracken Eradication
.. 22	6.20	As North Regional	—
Northern Ireland : April 9	7.30	Mr Peter Fitzpatrick	Farmers' Work and Worry.

NOTICES OF BOOKS

Land-Reclamation in Italy: Rural Revival in the Building of a Nation. By Cesare Longobardi. Translated from the Italian by O. R. Agresti. Pp. xii + 243, & 29 Figs. (London: P. S. King & Son, Ltd. 1936. Price 12s. 6d.)

This English version of an Italian work published in 1934 makes far from easy reading, but is a useful account of the machinery and aims of land reclamation under the Fascist regime. Stress is laid on the "integral" character of the work, as part of a co-ordinated movement for "rural revival"—a character which, it is claimed, the corporative system alone could have imparted. It is stated that on July 1, 1934, public reclamation works had been fully or nearly completed on 1,760,000 hectares (4,350,000 acres). Of this area, 780,000 hectares had previously consisted of unproductive or "extensively" cultivated lands, on which reclamation works proper have to be followed by agricultural conversion and settlement. The cost of Government and private works executed from 1870 to July 1, 1934, is given elsewhere as 8,000 million lire, of which works costing 6,000 million lire were executed in the twelve years of the Fascist era. Operations in the Pontine Marshes, including acquisition of lands, road-making, building, stump-extracting, breaking-up and conditioning the land, supplying water, etc., are stated to have cost 7,000 lire per hectare for the smaller farms and 2,500 lire per hectare for the larger farms in less fertile regions, or £31 and £11 per acre respectively. In Littoria and Sabaudia loan charges for drainage works and cost of maintenance average 70 lire per hectare, or 6s. per acre. "The plans are studied and selected so that the quota of costs charged to each owner may be expected to earn a normal rate of interest provided by the increased income derived from the land itself; and in the case of the Government so that the quota for which it is liable"—the maximum Government grant towards different public works varying from 60 per cent. to 100 per cent. according to the nature of the work, and even for works beneficial only to one or more farms from 25 per cent. to 75 per cent.—"is proportional to the economic and social advantage secured for the country." An allocation of that part of the cost met by landowners is provisionally made on the basis of benefit, and is revised on the completion of the works. Where the works result in a saving of expenditure to provinces and communes, they may be required to make—apart from any quota to which they may be liable as owners—a contribution not exceeding a quarter of the Treasury contribution. The execution and upkeep of the work is usually entrusted to a *consortium* of landowners, although either the landowners or the Government may have the final responsibility, according to the nature of the work. A large part, however, has been played by the National Foundation for Ex-Service Men, which may require land subject to reclamation obligations to be transferred to it.

An Introduction to the Principles of Plant Physiology. By W. Stiles, M.A., Sc.D., F.L.S., F.R.S. Pp. viii + 615 and 60 Figs. (London: Methuen & Co., Ltd. 1936. Price 27s. 6d.)

Botanists are only too familiar with the bewildering mass of original publications concerning the physiology of plants that have appeared during the last 20 years. In the absence of up-to-date text-books on this subject, it has frequently been beyond the capabilities of students who are working

NOTICES OF BOOKS

through an honours degree course in a limited time, to assess the relative value of apparently contradictory statements, or to extract information from these papers, and synthesise a clear picture of the essential features of the more important processes which make up the life of a plant. The result is that many botanists have no clear physiological background against which their activities in other branches of the subject can be clearly seen. For this reason Professor Stiles's book will doubtless be welcomed by many as a safe haven in which to anchor awhile, and take stock of the situation. With further lapse of time, a change in direction of the physiological wind may necessitate the erection of fresh breakwaters, or even the reorganization of the harbour itself, but this can be left for the future to decide.

The book is divided into four main parts, entitled: (i) The General Physiology and Development of the Plant Cell. (ii) Metabolism. (iii) The Physiology of Development. (iv) Irritability and Movement. There is also a useful list of more than 900 original papers to which reference is made in the text. Some of the information in parts i and ii is already available in Professor Stiles's own previous works, and in other books dealing with special aspects of plant physiology, but that in parts iii and iv will probably be found particularly valuable. The book is well written, easy to follow, and unnecessary or confusing detail has been omitted. All these desirable features could have come only from the pen of one who has thoroughly mastered the subject in hand.

The selection of material for inclusion in a book is always a difficult task, and in this instance much care has evidently been expended. It is important to realise, however, that only a small proportion of those taking an honours course in botany will in after life be engaged in researches in pure physiology. For purposes of general education it therefore seems desirable that special emphasis should be laid on the ways in which the principles of plant physiology can or might be applied to agricultural and horticultural practice, just as in a text-book of chemistry it is customary to show how general principles have been employed in industry. The book under review is essentially one that deals with principles rather than their applications, although these have not always been omitted. For instance on p. 393, the commercial possibilities which arise out of the work of Garner and Allard on the effect of length of day in controlling the flowering of plants, or how work on vernalization might be applied to facilitate the production of cereals (pp. 389-90) are indicated. On the other hand, no attention is drawn to the fact that the knowledge concerning growth-promoting substances, which has accumulated during the past 10 years, might be of use in attempting to propagate refractory plants by vegetative means. Since fields, gardens and greenhouses are the domains in which so many students have in later life to apply scientific knowledge to earn their daily bread, it seems probable that a closer relationship between laboratory work and commercial practice would be of great value to all concerned.

Professor Stiles's book is undoubtedly a very valuable addition to botanical literature, and is strongly to be recommended to all who are interested in plant physiology.

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The World Feeding-Stuffs Position

A good deal of attention has been aroused in recent months by the world rise in prices of animal feeding-stuffs, and a brief statistical review of the world position of the more important feeding-stuffs, barley, oats, maize and linseed, may be of interest.

Recent statistics published by the International Institute of Agriculture, Rome, are summarized in the following table of world production :—

	Number of Countries comprised in the total (a)	Percentage of world production (a)	Production in 1936-37	Increase (+) or Decrease (—) compared with	
				1935-36	Average of five seasons ending 1934-35
Barley ..	41	82%	485 million cwt.	— 12	— 10
Oats ..	36	98	802 million cwt.	— 16	— 13
Maize ..	23	84	1,443 million cwt.	— 17	— 17
Linseed ..	19	99	2,780 thousand tons	+ 11	— 2

(a) Russia and China excluded.

The harvests of barley and oats in Europe in 1936-37, although about 7 per cent. under average, were little different from those of the previous season, while the maize crop increased by about 27 per cent. on the year and 16 per cent. above average. Since 1932, linseed production in Europe has progressively expanded, and a further large increase was recorded in 1936-37.

The harvests of barley, oats and maize in North America were about one-third smaller than in 1935-36 and the production of linseed declined by more than one-half.

NOTES FOR THE MONTH

Good crops of barley and oats were taken in Argentina, and a first estimate of the maize harvest, although 5 per cent. less than last season's crop, is 10 per cent. above average. Linseed production in Argentina, although very slightly under average, was 32 per cent. more than in 1935-36.

Total shipments of feeding-stuffs, together with United Kingdom imports, during the first eight months of the present season, compared with the corresponding period in 1935-36, are given in the following table:—

	World Shipments, August to March		United Kingdom Imports, August to March	
	1936-37	1935-36	1936-37	1935-36
Barley, million cwt. ..	22.9	27.8	13.9	15.7
Oats " " ..	7.3	6.7	1.4	1.7
Maize " " ..	159.1	131.1	54.7	48.3
Linseed, thousand tons .	1560.6	1257.5	195.7	189.2

The bulk of the oats, maize and linseed shipments were supplied by Argentina, while Russia and the Danubian countries shipped the largest proportion of the world barley exports. Larger quantities than usual of animal feeding stuffs have been imported into the United States to supplement the poor crops taken in that country, and arrivals of maize in the United Kingdom were considerably above average.

The trend of prices in this country is shown in the following table of monthly average prices:—

			Imported Feeding Barley per cwt	Imported Oats per cwt.	Argentine Maize per cwt.	Linseed Cake per ton.
			<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>£ s. d.</i>
August, 1936	..	..	7 1	7 4	6 3	8 18 0
September	"	..	6 6	7 3	5 10	9 0 6
October	"	..	6 11	7 9	5 8	8 16 6
November	"	..	6 11	7 9	5 3	8 14 0
December	"	..	8 0	8 10	5 9	9 3 0
January, 1937	8 11	9 4	5 11	9 9 0
February	"	..	8 6	8 11	5 11	9 9 0
March	"	..	8 5	9 1	6 3	9 6 6
March, 1936	5 4	6 3	4 3	7 8 0

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The new maize and linseed crops in Argentina are good and should be available on the market in the near future. It is too early, however, for any indication of prospects for this season's crops in the northern hemisphere.

Dried Poultry Manure Experiments

A series of field experiments on dried poultry manure was carried out in 1936 by the Rothamsted staff in conjunction with Advisory Chemists, County Organizers, Farm Institutes and others along lines developed since 1933. Several of the experiments begun in 1934 and 1935 were planned to run a term of years and many of them were continued in 1936. Others on a similar plan were started. After the preliminary year it was decided to concentrate attention on the organic matter and nitrogen in poultry manure and to omit any further attempt to assess the value of the phosphoric acid in dried poultry manure by giving all plots in each experiment the same total amounts of P_2O_5 and K_2O , allowing for those in the poultry manure. It was agreed that the value of an organic manure such as poultry manure might not be properly estimated by considering only the immediate effects in the year of application. Attempts to measure either cumulative or residual effects necessarily complicate the form of the experiments. It is believed that the general pattern adopted in most of the recent experiments meets the requirements as satisfactorily as is possible with a moderate number of plots to be employed for a short term of years.

The experiments as a whole gave larger responses than in previous years, and thus gave a better opportunity for comparing poultry manure and sulphate of ammonia. The 1936 results are in good agreement with those of the earlier years, though both manures gave better results in the wet year 1936 than in the average of the three preceding drier ones. The variation between centres makes it unsafe to conclude from the information at present available that the cumulative effects of poultry manure are greater than those of sulphate of ammonia, but there are at least indications that this is so.

The results of the main series of trials indicate that the relative effects of poultry manure and sulphate of ammonia differed from crop to crop in 1936, but it must be remembered that the number of experiments in each group was small. It appears, however, that for the crops known to respond abundantly to inorganic nitrogen, the poultry manure is definitely inferior to

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sulphate of ammonia. There is, however, some suggestion that for special crops and for cumulative effects poultry manure may have advantages over sulphate of ammonia. The precise conditions must, however, be worked out more thoroughly before a definite statement can be made. For immediate effects on crops responding to inorganic nitrogen, poultry manure is definitely inferior to an equivalent amount of inorganic fertilizers. The average residual effect of poultry manure, judging from first-year residues in these experiments, was small relative to that of sulphate of ammonia, which in the 1936 experiment may well be assumed to have been zero.

While it is thought desirable to place the interim results of these experiments on record, it must be said that the results are tentative and that it is proposed to carry on the experiments for three more seasons. At the conclusion of the experiments it is hoped that there will be available definite data that will provide sound criteria for evaluating the material.

Interesting Birds: (3) The Kestrel

THE Kestrel is still fairly common in Great Britain, and is perhaps the most familiar of our birds of prey. The characteristic hovering flight, which in some districts has caused the Kestrel to be known as the "Windhover," makes its identification when in flight an easy matter. Like all birds of prey it is very keen sighted, and it may often be seen hovering at a considerable height, stationary and almost motionless except for the balancing action of the wings and tail, watching some creature on the ground beneath.

In general colour the male Kestrel is a light chestnut, spotted and streaked with black. The breast is buff, and the head and lower part of the back and tail are slate grey. The female differs in that the head, neck and tail are chestnut, barred or streaked with black.

The Kestrel makes no nest, being content to occupy the disused nest of a crow or some other large bird, or to lay its eggs in a cleft in a rock, in a hollow tree, or even on a ledge in some building. The eggs, which may number 4-6, are very handsome, and vary considerable in colour and marking. The most common form is one having a creamy or yellowish-white ground, so densely marked with rich red-brown that the ground colour is almost or entirely obscured.

The Kestrel's food consists almost wholly of mice, voles, young rats, and large insects. Sometimes, however, it takes



Photograph Copyright by Eric J. Hosking.

Kestrel, with Field Vole

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a small bird of one kind or another. Individual Kestrels may fall into bad habits and take to stealing young chickens and pheasants, but these occasional lapses should not be allowed to prejudice the species in the eyes of landowners or farmers. The Kestrel is, in fact, one of the most useful birds that we have, and is a good friend to agriculturists generally. In the destruction of rodent pests it has no superior, with the possible exception of the Barn Owl. Nowadays, happily, it escapes much of the persecution to which it was at one time subjected, and all occupiers of land should make it their business to protect and encourage so useful an ally.

Potato Synonyms

The following note has been communicated by the National Institute of Agricultural Botany:—

It was reported to the Council of the National Institute of Agricultural Botany, which met on April 15, that the work of the Potato Synonym Committee had resulted in the practical elimination of synonymous names from the catalogues of the largest seedsmen. Of these firms, only two refused to withdraw their synonyms, namely Cherub, Cleadon Park and Early Favourite.

Communications had recently been sent to a very large number of the remaining firms throughout the country suggesting where necessary that synonymous or alternative names be withdrawn from their catalogues. A gratifying response had been received, for out of 125 firms offering such names in their 1937 lists, 94 had already agreed to fall in with the suggestions of the Committee, while only 4 firms had definitely refused. In these instances the varieties were being grown at Ormskirk, and publicity would be given to the Committee's findings in due course.

Whey

In the Report of the Advisory Committee on Nutrition recently issued, attention is drawn to the nutritive value of whey. The Report says:

"The belief that whey is of no significant nutritional value is erroneous. Undoubtedly it is inferior to skimmed milk, cheese, or butter, but it is nevertheless sufficiently nutritious to warrant its use in human diets wherever it is available. Whey contains much of the sugar and minerals and some of the proteins and vitamins of the milk from which it was derived, and, as an ingredient of foods made from cereals, it would go some way towards correcting the deficiencies in such foods."

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The manufacturing industry is, in general, already well aware of the value of this by-product of cheese-making, and it is used to some extent already in the manufacture of certain patent milk foods. As to its constitution, it has 93 per cent. water, 5 per cent. milk-sugar and lactic acid, 1 per cent. soluble protein, and traces of mineral ash and butter fat. As a food substance it is, of course, highly diluted and subject to rapid deterioration. Where cheese is made on a small scale, whey is generally fed to pigs and should thus be well utilized on the farms. In large-scale cheese-making, whey is obviously a difficult by-product to deal with, as it must either be returned to farms for stock-feeding or concentrated sufficiently to permit of its transport to a central factory for the further processing and extraction of the milk-sugar. A large quantity of whey is at present sent from cheese-making factories in the West Midlands to the finishing depot at Haslington, near Crewe, where an excellent grade of lactose is produced for inclusion in certain patent foods. From this process there is a further by-product containing some minerals and proteins suitable for stock-feeding. It may well be that in large-scale cheese-making in the future, provision will always be made for the concentration of the valuable ingredients in whey, with a view to their utilization in various forms of milk and other foods.

Wild White Clover Certification Scheme

THE 1936 harvest of wild white clover seed was one of the smallest that has been known for many years. The supply of certified seed from fields that have been recorded under this scheme has been insufficient to meet the demand. The price of the seed is higher than it has been for several seasons, and stocks of wild white clover seed must now be very low.

There is a steady demand from the U.S.A. for English certified seed, and although this demand is not for a very great volume of seed at present, there is every indication that an increase is likely as soon as the satisfactory results from the inclusion of this plant in the seeds mixtures, particularly in the Eastern States, become more widely known.

About 9,000 acres of seed have been recorded under the scheme, of which approximately 7,700 acres are Grade A (old pasture that has been in grass not less than 10 years) and 1,300 Grade B (less than 10 years old and sown down with seed from a pasture which was not less than 10 years old). Over 3,600 acres that were submitted for inspection have not been

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recorded; of these, about 2,000 were either rejected on inspection or otherwise found to be ineligible, while the remaining acres were withdrawn from the scheme.

Farmers who intend sowing down fields to grass with a seeds mixture including wild white clover are advised that it is desirable to use certified Grade A seed, so that if they subsequently decide to harvest wild white clover seed, the fields will be eligible for recording under the scheme.

Seed offered for sale is sometimes described by the seller as being from an inspected pasture, but it should be understood that, where no reference is given to the certificate number, the buyer has no guarantee that inspection of the pasture was followed by its acceptance and recording under the scheme. It is therefore advisable to quote the certificate number in all sales of certified seed.

This scheme for the recording of fields and the certification of seed is a voluntary and self-supporting one that is being operated jointly by the Ministry of Agriculture and the National Farmers' Union. Full particulars can be obtained on application to any County Secretary of the National Farmers' Union or direct from the Secretary of the Central Wild White Clover Committee of the National Farmers' Union, 75, Bedford Square, London, W.C.1. The scheme is not limited to members of the National Farmers' Union. Application for inspection of pastures this year must be in the hands of the National Farmers' Union by May 15.

Scientific Principles of Poultry Feeding

FOR the 4th edition of the Ministry's Bulletin No. 7,* which the Ministry has recently issued, the author, Mr. E. T. Halnan, has incorporated the new knowledge that has been acquired since the appearance of the 3rd edition. As a result, several sections of the work have been rewritten, and much new material has been added. In the new sections dealing with poultry dietetics, the relation of feeding to the quality of eggs and flesh, the relation of nutrition to the moult, the relation of minerals to growth and egg production, and the factors affecting palatability, have been given special attention.

Methods of feeding poultry were once more or less of a rough-and-ready kind, and were based almost entirely on

* Obtainable from His Majesty's Stationery Office or through a bookseller. Price 1s. (by post 1s. 2d.).

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empiricism. Such methods may have been excusable so long as poultry were regarded merely as scavengers or as a means of using up inferior grain produced on the farm, or while the average egg yield was small and production was almost confined to the spring and summer months. In view, however, of the greatly increased demands that are now made upon the egg-laying capacity of fowls, especially in the autumn and winter, and of the present desire for quicker growth and earlier maturity, it is clear that it is vitally important to base feeding methods upon both scientific and economic factors. Further, the close relation between nutrition and disease is now generally appreciated.

Evidence continues to accumulate to indicate that a ration that is deficient in certain constituents may be directly responsible for the appearance of certain diseases. There is, in fact, reason to suppose that, in some instances the progress of disease in infected birds may be checked by an appropriate ration. Apart from this question of the more direct preventive or curative influence of diet on disease, it is of great importance that the nutritive requirements of the fowl, whether for the production of normal growth, eggs, or flesh, should be satisfied. Research into the problems of poultry nutrition has lagged behind similar work in connexion with larger farm animals. With the establishment of the National Poultry Institute a few years ago, the position in this respect has been largely remedied, and recent investigations throw considerable new light on the subject.

The Bulletin is divided into several main sections—The Essential Constituents and Functions of Food; The Anatomy of the Digestive System of the Fowl and its relation to Diet; Digestibility from a Practical Standpoint; The Anatomy of the Egg-Producing Apparatus of the Fowl and its Relation to Egg Production; Poultry Dietetics; Feeding Standards in Relation to Poultry Production; and The Quantitative Requirements. In addition, there is described a system of table poultry production suitable for farmers, and some short notes on feeding stuffs for poultry are given.

Electro-Culture Committee Report

THE Electro-Culture Committee, which was set up 18 years ago by the Ministry, under the chairmanship of Sir John Snell, G.B.E., M.Inst.C.E., has now issued its 18th and Final Report.

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The main object of the Committee was to determine the effect of overhead electrical discharge upon growing crops; and experiments on a field scale and on pot cultures were carried out under the supervision of Professor V. H. Blackman, Sc.D., F.R.S., mainly at the Rothamsted Experimental Station by courtesy of the Director, Sir John Russell, F.R.S.

The difficulties in connexion with the field experiments were found to be so considerable that these experiments were discontinued after 1922 and the work confined to pot cultures.

The results of the pot culture work, briefly set out in the Report, show that such increases in yield as have shown themselves have been of the order of 20 per cent. only, and have been very erratic in their occurrence.

The report states that:—

“In spite of the failures of recent years, the field results obtained some years ago and the earlier pot culture results would seem to have established the fact that the electro-culture effect is a real one. It would seem, however, to be of little advantage to continue the work either on economic or on scientific grounds. Increases of 20 per cent. can hardly be considered economic even if obtained in most years; experiments, however, demonstrate that the regular occurrence of the effect cannot be expected. On the scientific side the erratic occurrence of the phenomena to be investigated—a vagary possibly related to weather conditions—renders their full study impossible.

“Although the economic results of the work of the Committee have been nil, this prolonged investigation has not been without value. Electro-culture applied to crops by an overhead discharge has excited considerable interest both in this country and abroad, and very high claims have been made for it. The elaborate studies which the Committee have undertaken during a period of 18 years do not support these claims. The study carried out over so many years has in fact brought to light the difficulties associated with the scientific study of electro-culture by reason of the other variables involved.

“The Committee regret that after so exhaustive a study of this matter the practical results should be so disappointing.”

The Plum Sawfly

At a conference of plum growers arranged by the Worcestershire County Education Authorities a few weeks ago, Dr. H. G. H. Kearns, of the Long Ashton Fruit Station of the University of Bristol, gave some interesting information and advice concerning Plum Sawfly. It appears that the fly was noted in Worcestershire as long ago as 40 or 50 years, but, strangely enough, did not do any appreciable damage to plum crops until recent times. During the past five years, it has been on the increase, and last year, had it not been for the exceptional plum harvest, the fly attack would have been badly

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felt. As it was, the pest thinned many orchards most obligingly. Dr. Kearns thinks that the pest is to some extent being encouraged by the modern tendency to plant coloured plums instead of the "Yellow Egg" plum, the Sawfly showing marked preference for the coloured varieties. Also, the modern system of intensive planting may have something to do with it. As regards its preference for coloured varieties, "Czar," "Victoria" and damsons appear to suffer most, particularly "Czar." A great deal, however, depends upon the state of the blossoming when the fly emerges. The flowers offer the greatest attraction just after they are in full blossom. If "Czar" happens to blossom early, and the fly emerges late, then it is quite possible to find in that year an attack on "Yellow Egg," while "Czar" goes free. Another point of interest is that whilst in some years the pest concentrates locally, in others, it spreads all over a district.

Briefly, the life history of the Sawfly is that it emerges and lays its eggs about mid-April to mid-May, according to climatic conditions, which, of course, also rule the time of plum blossoming. The eggs are laid in the "cot" of the blossom, but there is no conspicuous puncture as with the Apple Sawfly in apples, and this makes attack difficult to detect. Each female lays about 30 eggs, and 14 to 18 days are required for incubation.

As the plum fruitlet swells there is pressure exerted on the "cot," and this, which is now dry and partially shrivelled, splits at the stalk end. When the majority of these dried "cots" are split for two-thirds of their length but are still sticking to the fruitlets, the eggs hatch and the larvae consume a piece of skin from off the fruitlet which they immediately enter. A week elapses between the hatching of the eggs and the entry of the larvae into the second fruitlet. The careful noting of the above condition of the dried "cots" is one of the most important guides to the right time for spraying, which should take place just prior to the hatching of the eggs and before the larvae enter the fruitlet. If undeterred, the larvae will remain in the fruitlet for several days, then emerge, and enter other plums up to perhaps seven in number. At four to five weeks old, the larvae fall or wander to the ground, enter the soil and pupate, spinning the usual Sawfly cocoon.

It is difficult to find eggs or the evidence of egg-laying without recourse to some such method as the following. Between full blossom and petal-fall, take a beating tray of

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black cloth or an inverted umbrella and hold this under the branches, giving the latter a sharp tap with a stick. The flies will then fall into the tray and remain a few seconds before flying away. This method of observation carried out on several consecutive warm evenings on the same trees provides an approximate idea of the chances of infestation. A consistent absence of sawflies on days favourable for their flight may be taken as a fairly safe indication that the infestation will be negligible. As to control, two applications of a wash are recommended, the first at the time when the "cots" have split longitudinally for two-thirds of their length, and the second a week later. The washes recommended are either Derris or Barbasco ground root with a wetting preparation, e.g., $2\frac{1}{2}$ lb. Derris (1.5 per cent. crystalline rotenone) and $\frac{1}{2}$ lb. Agral II, or Lethelate Wetting Preparation, or Sulphonated Lorol; or the same quantity of Derris or Barbasco with 1 gal. of White Oil Emulsion (6.7 per cent. oil); either preparation to be diluted to 100 gal. with water. The amount of Derris or Barbasco ground root or their extracts per 100 gal. wash depends on their content of crystalline rotenone. The concentration of crystalline rotenone in the wash should be not less than 0.004 per cent. Of the two sprays, the latter is the more effective. The second application of the wash ensures a high control of both Sawfly and Red Spider.

SOME DEFICIENCY DISEASES OF CROP PLANTS

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THE necessity for feeding the soil in order to improve the yield and quality of crops has been recognized from time immemorial, the materials generally used being those most readily available, particularly animal excreta with or without litter, seaweed, etc. With the progress of agricultural science it became clear that these complex manures supplied a variety of plant foods, the most obviously important being nitrogen, phosphate and potash, in addition to organic matter or humus. During the last century the practice has arisen of supplementing these organic manures with chemical or "artificial" fertilizers supplying one or more of the essential plant foods, and since the available quantity of organic manures has been much lessened by the increasing use of mechanical, instead of horse, traction the artificial fertilizers are steadily increasing in importance.

During recent years it has gradually become apparent that the requirements of many plants are not entirely satisfied by the supply of the principal plant foods that were previously recognized, but that very small amounts of other elements are also necessary. Various obscure diseases or conditions of general unhealthiness are controlled or prevented by the presence of traces of such elements as boron, manganese, copper, and zinc, to mention only those about which most is known. The probable importance of some of these accessory or minor elements was indicated by scientific workers long ago, but the practical application of the facts is of comparatively recent date, and has sometimes resulted from an accidental observation that led to more extended inquiry. During the last few years, interest in the matter has become world-wide, and practical men and research workers in many countries are carrying out experiments and field trials and publishing their results for the benefit of others.

The difficulties in the way of establishing the facts are many. With the ordinary fertilizers it is comparatively easy to find out what is required by any soil, and, within reasonable limits, it is unlikely that sufficient will be given to damage the crops. The minor elements, however, are required in such

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small quantities that soils usually contain sufficient of most of them, and it is extremely difficult to determine if any are deficient. Also, most of these elements and their compounds are poisonous to plants in very low dressings and great care is needed in their use.

Boron. From the practical point of view, active interest in these minor elements is naturally not roused until it becomes apparent that their deficiency in certain soils is the cause of trouble in crops. Although Warington^{10*} proved conclusively in 1923 that the development and flowering of broad beans was absolutely dependent on the presence of a trace of boron, the active ingredient of borax, the discovery at the time seemed of little practical value. Enterprising scientific workers in various parts of the world followed the matter up, however, and the value of dressings of a few pounds of borax per acre in certain instances soon became apparent. "Top sickness" of tobacco in Sumatra is now controlled by the addition of borax to the fertilizers as a matter of routine. In Canada and elsewhere the losses of turnips and swedes due to Brown Heart have been very greatly reduced by the same means, and in New Zealand there are indications that the disease of apple fruits known as Internal Cork is due to an insufficient supply of boron. The most striking and universal results, however, have been made in connexion with Heart Rot or Crown Rot of sugar-beet. This disease causes heavy losses in yield of roots and sugar, and also adversely affects the production of seed where crops are replanted for this purpose. The first visible symptom is a shrivelling of the central rosette of leaves or, in the second-year growth, injury to the growing stem, which begins to die from the top downwards, with a characteristic blackening due to the breaking down and decay of the stem tissues. This is succeeded by the production of a number of side shoots around the crown, which, in their turn, may show symptoms later if the disease is not controlled. The bunched side shoots give a curious "parsley top" appearance to the plant, arousing suspicion when seen. The root injury shows itself in a breaking-down and blackening of the central part, often associated with a type of dry rot that spreads inwards from the outside, and may be aggravated by attacks of fungi that find a suitable home on the decayed tissue. Before the cause of the disease

* For references see p. 122.

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was found to be boron deficiency it was frequently attributed to fungal attack, but it is now established that the fungi are secondary invaders. Heart Rot is usually most in evidence in hot, dry summers, and with the advent of cool, wet weather the severity of the disease is mitigated and some recovery may take place.

The characteristic symptoms of boron deficiency appeared in 1935 in a field of sugar-beet at Rothamsted, and the opportunity was taken to determine how far the second year's growth of flowering stems could be influenced by the use of boron. A number of affected and of apparent healthy roots were transplanted into pots filled with sand supplied with fertilizer, small doses of boric acid being given to some pots and not to others. In the latter, the characteristic symptoms of deficiency appeared even on plants that were healthy when lifted, the shoots and young flower buds turning black and dying. In the plants that received boric acid the tops remained green and healthy, the flowers developed normally and fruit would doubtless have ripened if it had not been necessary to stop the experiment. This happened even on plants that showed deficiency in the field, thus indicating that when seed production is the object, late treatment with borax might prove successful even when the deficiency had not been remedied at an earlier date.

In the Irish Free State⁴ extensive field trials were carried out for several years at numerous centres where Heart Rot was prevalent. Effective control was secured with 28 lb. of borax per acre, but as this is getting near the border line of danger, the lower treatment of 21 lb. per acre is probably more economic, as very few plants showed disease at this rate. Application with the seed was the most satisfactory, though good results were obtained by top dressing when the disease first appeared. Norfolk experiments³ confirm the rate of application, and emphasize the need for very careful distribution of the borax, to prevent some areas from getting insufficient to control the disease, while others receive enough to harm the crop. It is obviously impossible to distribute evenly so small a dressing as 21 lb. per acre, and admixture with sand or fertilizer is recommended. In the latter event it is essential to mix the borax with superphosphate or potash manures before the addition of sulphate of ammonia, as direct admixture with the sulphate depreciates the value of the fertilizer.

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Brown Heart (" Raan ") of swedes affects the central portion of the bulb, which becomes mottled with brown areas of diseased tissue, thus diminishing the feeding value and spoiling the cooking properties. The symptoms appear to be confined to the root portion of the bulb, and do not extend into the upper part (which botanically is stem tissue) or into the leaves. Consequently it is impossible to detect Brown Heart in the growing crops without special search. The results of experiments in Scotland^{5,6} and Wales¹¹ have confirmed that the trouble is due to boron deficiency, and dressings of 15-20 lb. of borax per acre are recommended where required. The trouble does not usually show itself in the early stages of development, and the suggestion is made that when rapid growth occurs on well-manured land the plant uses up any available boron from the soil to which it has access by its root system, and then suffers from deficiency. White- and yellow-fleshed turnips were at first thought to be immune from Brown Heart, but it is now known that the yellow-fleshed varieties, at least, are somewhat susceptible, and further evidence from other parts of the country would be very valuable.

Both Brown Heart of swedes and Heart Rot of sugar-beet are more prevalent on alkaline soils, and it is thought that the lime present locks up the boron in some way, thus rendering it useless to the plant, and inducing deficiency. This prevalence on soils rich in lime has also been observed abroad, as in Hungary and Denmark, but the trouble also occurs occasionally on neutral or slightly acid soils.

There is some evidence that potatoes may suffer from lack of boron, though their needs are apparently not as great as those of beet and swedes. In Scotland, O'Brien and Dennis⁷ have obtained results which suggest that a non-parasitic disorder, simulating Leaf Roll and often conspicuous in dry seasons, may be prevented in some varieties by the use of 10 to 20 lb. of borax per acre before planting, the treatment also increasing the yield.

Manganese. Boron is the subsidiary plant nutrient that has perhaps attracted most attention in this country on account of its proved economic value. Many other elements are widely distributed in soils in very small quantities, and it is not easy to find out which are really needed by plants, and whether certain instances of defective crop growth are due

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to a deficiency of one or other of them. It is generally acknowledged that manganese is required by plants, but true instances of manganese deficiency are often difficult to recognize. The most definite information is in connexion with the Grey Leaf disease of oats which was proved to be due to manganese deficiency by Samuel and Piper in Australia in 1928.⁹ The disease is more prevalent on well limed soils than on those that tend to be acid, and is characterized by stunted growth associated with yellowing of the leaves and death of the growing points. Applications of manganese sulphate up to 1 cwt. per acre have often been found effective in controlling the trouble both in this country^a and abroad. In Scotland, Brown Heart of swedes was at first suspected to be a possible manganese deficiency disease,⁵ but though manganese is essential for the development of the plants, it is useless against Brown Heart, which is prevented only by the application of boron.

In some districts peas are subject to Marsh Spot disease, which affects the seeds and depreciates their market value. There is a certain amount of evidence that this may also be due to deficiency of manganese in the soil, as some amelioration has been obtained by treatment with manganese sulphate solution,⁸ but further confirmation is needed from tests carried out in different seasons. Care is needed in the use of manganese fertilizer just as much as with borax, as large amounts are definitely poisonous, and cause yellowing or "chlorosis" of the leaves, and this trouble must not be confused with a somewhat similar discoloration caused by deficiency of the element.

Copper. Apart from boron and manganese no other subsidiary element has yet come within economic range in the British Isles, but the possibility exists that others may eventually prove to be important in certain places or for particular crops. Abroad, the value of copper is recognized as a preventive of the "reclamation disease" that affects crops on land that is reclaimed for cultivation after the removal of surface peat, and in Holland about 30 lb. of copper sulphate per acre are added as a matter of routine when such land is first broken up. In Florida, also, extraordinary results have been obtained by applying a similar amount of copper sulphate to the very infertile saw-grass peat land, better crops of tomatoes, lettuce, beet, rape, etc., being obtained

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in this way than by the use of liberal dressings of organic fertilizers.

Zinc. Zinc also has been found valuable as a specific against certain diseases of fruit trees that are characterized by mottling or deformation of the leaves, zinc sulphate causing considerable improvement when added to the soil at the rate of from $\frac{1}{4}$ to 15 lb. per tree, according to species and size. It is not, however, proved that either copper or zinc is required for growth, though they may be needed in certain instances, but boron and manganese are definitely essential for most, if not all plants, and their presence in the soil in sufficient amount is of definite economic importance.

General. The growing interest in the deficiency diseases of crops is largely due to the increase of our knowledge as to their cause and remedies, but it is also probable that they are actually more prevalent than they used to be. Organic fertilizers, such as farmyard manure, contain a considerable variety of elements, and their continued use helps to maintain the requisite supply of the nutrients that are needed only in small quantities. This source of supply has become less with the decreasing use of organic manure and the increase in artificial fertilizers, particularly with the continued improvement in the purity of the latter. It is quite possible that, owing to this, on some soils the available amount of such subsidiary plant foods as boron and manganese is falling below the limits required by certain crops, with the result that deficiency diseases appear or become more widespread than formerly. It is of great importance that this fact should be realized and careful watch kept for signs of trouble, as unnecessary loss may otherwise be incurred. In those instances where the cause of deficiency is already known the remedy is cheap, readily available and easy of application. In others, where deficiency is suspected, but not traced to its source, it may be anticipated that further information will become available if the active co-operation between practical agriculturists and scientific workers is maintained and fostered.

At this stage a word of warning may not be out of place. The majority, if not all, plant nutrients become poisonous or at least somewhat harmful if they are supplied in too great quantities. Large amounts of nitrogen, potash or phosphate are necessary before any damage occurs, but quite small

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amounts of borax, copper, zinc, etc., are actively poisonous and will severely damage or even kill the plants. For instance, considerable losses of potatoes and other crops occurred in America during the War owing to the use of fertilizers containing borax ranging up to 2·3 per cent., especially when it was applied in the furrows,¹ and the harmful effect of excess manganese has already been mentioned. As the symptoms of deficiency and poisoning may resemble one another, care is needed to avoid confusion, and the possible supply of toxic amounts of certain elements in artificial fertilizers needs to be guarded against. In one instance, for example, it was found that the failure of basic slag to produce results proportional to expectations was apparently due to the presence of small quantities of vanadium, whose poisonous properties acted in opposition to the beneficial effect of the phosphorus in the slag.

For the reasons given, it is advisable that applications of such substances as borax and manganese sulphate should be made only where they are known to be needed, and the general consensus of opinion is against their inclusion in compound fertilizers for general use. Some crops need so much less of these subsidiary nutrients than others that there is danger of accumulation of poisonous quantities in the soil if dressings are applied without discrimination.

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COUNTY COUNCIL SMALL-HOLDINGS IN DORSET AND HAMPSHIRE:

II. DAIRYING SMALL-HOLDINGS

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The Sample. The information in this section is based on data from 85 small-holdings, 59 in Dorset and 26 in Hampshire. The majority of the Dorset holdings were situated north of the chalk belt in the Blackmore Vale region, the others being more or less concentrated in the south of the county in the Bridport area. Most of the Hampshire holdings were situated in the district around Mattingley to the north-east of Basingstoke.

The total area of the holdings was 4,633 acres, 46 being over 50 acres and 39 under 50 acres in area. As regards 19 holdings part only of the total acreage farmed by the holders was county council land, the remainder being either rented from private owners, or, in a few instances, owned by the smallholder himself.

Type of Farming. All 85 holdings were primarily dairying holdings concerned mainly with the production of milk for liquid sale. Nevertheless, most of the holdings had some other supplementary enterprises, usually pigs or poultry or both. The most popular combinations were: dairying, poultry and pigs (28); dairying and poultry (18); dairying only (13); dairying and pigs (7); other combinations (19).

The holdings were predominantly grassland holdings, only 9.5 per cent. of the total acreage being under the plough. The management of the grass land conformed to local practice. Approximately 46 per cent. of the total 4,126 acres of grass was cut for hay. Generally the same fields were kept for hay each year, though in several instances there was some attempt at rotation of fields. Many of the smallholders considered that the fields were too large for the proper management of small farms. Practically all the farmyard manure produced on the holdings found its way to the hayfields. About one-fifth of the smallholders also applied artificial manures to some portion of the land every year.

The total area under the plough was only 441 acres. One-half of the holdings had no arable land at all, and only 24

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holdings had over 10 per cent. arable. Moreover, in most instances the arable land was used for producing food for consumption on the farm. Only 19 holdings sold any arable produce.

The relative importance of the various classes of livestock is well illustrated by the following figures of the total number of each class of livestock on the holdings when visited :

Cattle -	-	-	1,734	Pigs -	-	-	507
Horses -	-	-	153	Poultry -	-	-	10,407

Of the total cattle population 1,364 were cows and heifers in milk or in calf, 222 yearling or 2-year-old heifers, 94 calves and 54 bulls. Grouping the holdings according to the size of the dairy herd, 15 kept under 10 cows, 31 had from 10 to 15 cows, and 39 had over 15 cows. On 75 holdings the cows were either Shorthorns or Shorthorn crosses. No holding had a pedigree herd, though one herd was in process of being graded up for registration. Only 47 holdings kept a bull, so that 44 per cent. of the smallholders had to hire bull service. Pedigree bulls were kept on three holdings only. On 31 holdings all the herd was home-reared, 22 holdings reared some and bought some and 32 holdings sold all their calves. Several of the smallholders at present rearing all or some of their cows were contemplating a change of policy, partly because they were cramped for rearing space and partly because they thought the process too expensive. Those who bought in all their replacements were generally satisfied that it was the more economic policy, since the holdings were too small to admit of a rearing system without reducing the number of productive cows. In general, the calves were sold at from one to six weeks old, but on 14 holdings it was the practice to fatten all calves before selling. Contagious abortion and Johnes' disease had been serious on 12 holdings, four smallholders attributing the trouble to defective water supply.

No horses were kept on 7 holdings, 23 holdings had one horse each, 43 had two horses and 12 had three or more horses. There was some co-operation in horse labour on the smaller holdings, while holdings having three or four horses used them for outside work such as haulage.

While 44 holdings numbered pigs among their enterprises, at the time of visiting only 39 holdings had pigs. The total number kept was 507, of which 75 were breeding sows.

All the holdings except 9 kept some poultry, 30 had less

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than 100 birds and 46 had over 100 birds per holding. On practically all of them production of eggs was the main object, very little attention being given to table birds.

Capital Invested. From here onwards the information given is for 60 smallholders only, as only 60 were able to supply full data about their financial results. The figures given cover roughly the farming year ending September, 1935.

The average capital invested per acre and per cent. in live-stock, implements and machinery for all 60 smallholdings is shown in Table I.

TABLE I
AVERAGE CAPITAL INVESTED PER ACRE AND PER CENT. ON
60 DAIRY SMALL-HOLDINGS

				<i>Per acre</i>	<i>Per cent.</i>
				£ s. d.	
Dairy herd	..	..	..	7 6 6	67·5
Horses	..	..	..	0 11 6	5·3
Pigs	..	..	..	0 2 7	1·2
Poultry	..	..	..	0 7 7	3·5
Implements and Machinery	..			2 8 10	22·5
				<hr/> £10 17 0 <hr/>	<hr/> 100·0 <hr/>

The above figures emphasize the preponderating importance of dairying on these holdings, 67·5 per cent. of the average investment of £10 17s. 0d. per acre being on account of this enterprise. The heavy investment of £2 8s. 10d. per acre for implements and machinery and 11s. 6d. per acre for horses illustrates one of the most serious difficulties of the small farm.

Expenses. The average expenses per acre and per cent. are set out in Table II.

TABLE II
AVERAGE EXPENSES PER ACRE AND PER CENT. ON 60
DAIRY SMALL-HOLDINGS

				<i>Per acre</i>	<i>Per cent.</i>
				£ s. d.	
Rent and rates	..	..	..	2 3 6	21·3
Family labour	..	..	..	2 8 0	23·5
Hired labour	..	..	..	0 18 4	8·9
Feeding stuffs	..	..	..	2 12 6	25·7
Dairy livestock	0 13 6	6·6
Other livestock	0 8 0	3·9
Miscellaneous	1 0 8	10·1
				<hr/>	<hr/>
Total expenses	£10 4 6	100·0
				<hr/>	<hr/>

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The average total expenditure of £10 4s. 6d. per acre shown in the table does not represent an actual outgoing of this amount, for it includes an estimated wage for the family labour employed. This family labour has been assessed at the county rate of wages appropriate to the various classes of family workers. It amounted to the equivalent of £2 8s. 0d. per acre. The actual cash expenditure of these 60 smallholders was, therefore, equal to an average of £7 16s. 6d. per acre.

When an estimated charge for family labour is added to the wages bill it is clear that labour was the biggest item of cost, accounting for 32·4 per cent. of the total. Hired labour was not a relatively big item, although amounting to 18s. 4d. per acre, or 8·9 per cent. of total expenditure.

The second biggest item of expenditure was that on purchased feeding stuffs, amounting to roughly one-quarter of the total. The bulk of this expenditure of £2 12s. 6d. per acre was incurred in buying food for the dairy cows, though on some holdings the food bill for pigs and poultry was also important.

Rent (and rates) figures as the third biggest item of cost, accounting for 21·3 per cent. of the total and amounting to £2 3s. 6d. per acre.

The miscellaneous costs (£1 0s. 8d. per acre) in order of importance were as follows: purchase and repair of implements, blacksmith, veterinary and medicines, manures, seeds, thatching, carriage charges and hire of machinery.

Receipts. The average receipts per acre and per cent. are shown in Table III, and provide a good indication of the type of farming, emphasizing still further the dependence of these smallholders on their milk cheques:—

TABLE III
AVERAGE RECEIPTS PER ACRE AND PER CENT. ON 60
DAIRY SMALL-HOLDINGS

						<i>Per acre</i>	<i>Per cent.</i>
						£ s. d.	
Milk	..	..	..	..	..	8 3 4	71·0
Dairy livestock	..	..	..	..	..	0 14 8	6·4
Eggs and poultry	..	..	..	..	..	1 3 3	10·1
Pigs	..	..	..	..	..	1 2 0	9·6
Crops	..	..	..	..	..	0 4 6	1·9
Sundries	..	..	..	..	..	0 2 3	1·0
Total receipts						£11 10 0	100·0

COUNTY COUNCIL SMALL-HOLDINGS

The average figure of £11 10s. 0d. per acre for receipts is inclusive of the estimated value of the produce of the holdings consumed by the smallholders' families. Assessed at average farm prices the value of the produce consumed by the families was equal to £15 2s. 0d. per family per annum. All 60 families were self-sufficing as far as milk was concerned, the average consumption being approximately equal to 140 gallons per family per annum. Fifty-five holdings produced their own eggs, the average consumption per family being roughly 78 dozen eggs per annum; in addition these families consumed about 25 fowls per family per annum. Fifty-three families stated that they produced their own supplies of potatoes, and four families produced their own bacon supplies. On seven holdings rabbits were said to be important both for family consumption and for sale.

Nearly four-fifths of the total income of these holdings was derived from the dairy herd, 71 per cent. coming from milk sales and 64 per cent. from sales of dairy livestock. Of the total milk available for sale 92 per cent. was sold wholesale, 6.9 per cent. sold retail and 11 per cent. consumed by the families. The 60 smallholders comprised 6 producer-retailers, 34 who sold all their milk wholesale and 20 who sold the bulk of it wholesale with some retail sales also. Of the total receipts of 14s. 8d. per acre for dairy livestock 47 per cent. was for calves and 45 per cent. for cast cows.

The other items of receipts in order of importance were : eggs and poultry, pigs, crop products and sundries mostly derived from work done outside the holdings—such as haulage and ploughing.

Profits and Losses. The average profit (i.e., excess of receipts and closing valuation over payments and opening valuation) for the 60 holdings was equal to £62 1s. 10d. per holding or £1 0s. 3d. per acre. This average figure is, however, inadequate for it gives no indication that 23 of the 60 holdings actually worked at a loss. Moreover, the various sizes of holdings show considerable variations in the degree of success obtained. A better picture of the position is supplied by Table IV where the 60 holdings are arranged in three groups according to the size of the dairy herds, and the frequency distribution of profits and losses within each group is shown.

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TABLE IV
PROFITS AND LOSSES ON 60 DAIRY SMALL-HOLDINGS

	<i>Group I</i> (13 holdings with less than 10 cows)	<i>Group II</i> (26 holdings with from 10 to 15 cows)	<i>Group III</i> (21 holdings with over 15 cows)	All holdings
	<i>No.</i>	<i>No.</i>	<i>No.</i>	<i>No.</i>
<i>Profit per holding :</i>				
Over £100 ..	2	6	9	17
From £50 to £100 ..	3	5	4	12
From £25 to £50 ..	2	4	0	6
Less than £50 ..	0	1	1	2
				61·7%
<i>Loss per holding :</i>				
Less than £25 ..	4	4	3	11
From £25 to £50 ..	1	1	2	4
Over £50 ..	1	5	2	8
				38·3%

The profit and loss figures in Table IV show the amounts available to the smallholders after all expenses other than interest on capital and remuneration of management had been met. In addition to the profits shown the smallholders had the use of the farmhouse free of rent and rates, and had also been credited with wages for all manual work performed by them and their families.

In view of the great significance of family labour and the possible objections to its assessment at the prevailing wages for hired labour, it is necessary to show the final results in the form of the amount available as "family income", i.e., omitting the charge for family labour. When this is done the holdings, with one exception, showed a surplus income. The position is illustrated in Table V.

TABLE V
AVERAGE "INCOME" PER FAMILY AND PER PERSON ON
60 DAIRY SMALL-HOLDINGS

	<i>Average family income</i>	<i>Average income per person †</i>
	£	£
Group I	133	101
Group II	167	117
Group III	220	143
	—	—
All Groups	178	124
	—	—

† All members of the family working on the holding have been converted to the common denominator of "man-equivalent."

COUNTY COUNCIL SMALL-HOLDINGS

It may be that the results as shown in this table provide a better indication of the standard of living of the smallholders concerned. They certainly explain why it is possible for these smallholders to carry on even though it can be demonstrated that according to more rigid financial standards many of them are running "unprofitable" businesses.

The results as given in Table IV show that each of the three groups had its quota of "successful" and "unsuccessful" holdings. This indicates that the holding after all only provides the chance for the occupier to show his intelligence, and that it is the capability of the man himself that is the most important factor. Nevertheless, the dispersion of profits and losses in Table IV indicates also that the man with the larger holding has a better chance of succeeding. A comparison of the 12 holdings making the biggest profits with the 12 holdings making the biggest losses brought out the following relative characteristics of the profitable dozen: larger acreages and larger herds; higher milk output per cow and per acre; higher expenditure on feeding stuffs; more economical use of labour as shown by a higher return per £1 labour cost; slightly lower rentals; relatively more diversity of enterprises with the milk cheque accounting for a comparatively lower percentage of total income.

(To be continued.)

STEM EELWORM DISEASE OF FIELD BEANS

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THE Stem Eelworm (*Anguillulina dipsaci*) is one of the most injurious and widespread of the plant-parasitic eelworms. A voluminous literature has arisen with reference to the occurrence of the various strains of this eelworm on a variety of cultivated crops.^{1*} There has, however, been little information recorded concerning Stem Eelworm disease of field beans (*Vicia faba*) in this country since the writings of Ormerod² and Bos³ towards the end of the last century. Since that time attacks have been recorded by Theobald⁴ in Kent and Petherbridge⁵ in the Eastern Counties.

The present writers have encountered a number of cases of severe injury to the bean crop during recent years, especially during the past season, and the following account summarizes their observations.

The Nature of Stem Eelworm Disease in Beans. Ormerod has described the condition of a number of diseased plants received from a correspondent, and Bos, to whom the material was submitted, identified the Stem Eelworm as the cause of the trouble and also described the symptoms exhibited by the plants. Neither of these workers had the opportunity of observing the disease in the field and it is felt, therefore, that the following observations may be of interest.

The first obvious signs of injury in the bean crop, which, it should be added, is autumn-sown in Yorkshire, are noticeable during late February or early March. Patches occur in which a number of plants are retarded in growth. Many of these plants die off, or if they survive remain stunted, so that by the time the pods are formed they may have reached a height of not more than 12 in. Fig. 1 shows a badly diseased plant of this type taken in early July from a crop sown the previous October. The poor development of such plants and the rapid death of many of them quickly produce bare or almost bare patches in the field. As the infestation progresses, plants that have not been severely stunted show characteristic

* For references, see p 136



FIG. 1.—Bean Plant stunted and distorted by Stem Eelworm attack

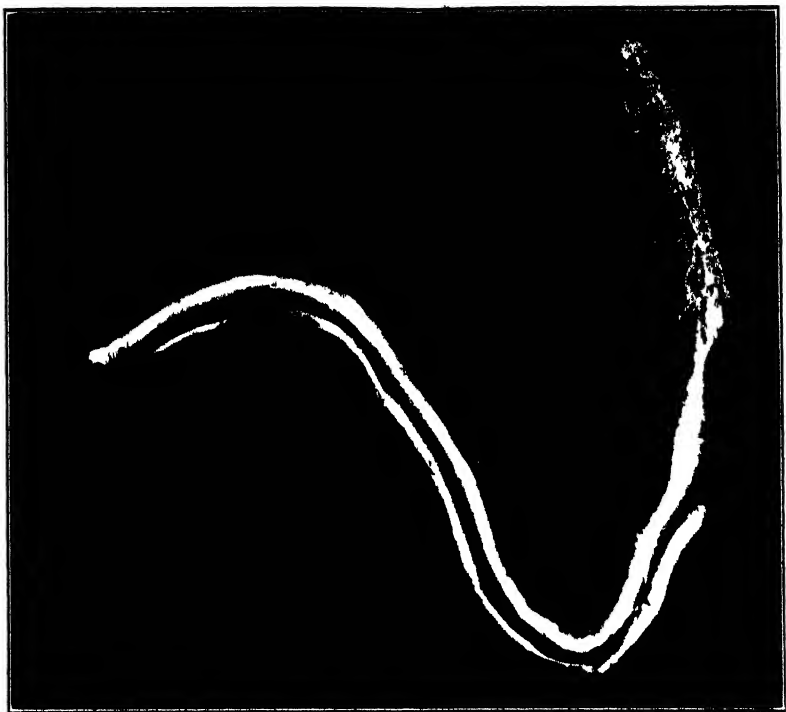


FIG. 2 —Base of Stem of attacked mature Bean Plant, showing discoloured Pith and bending of the Stem

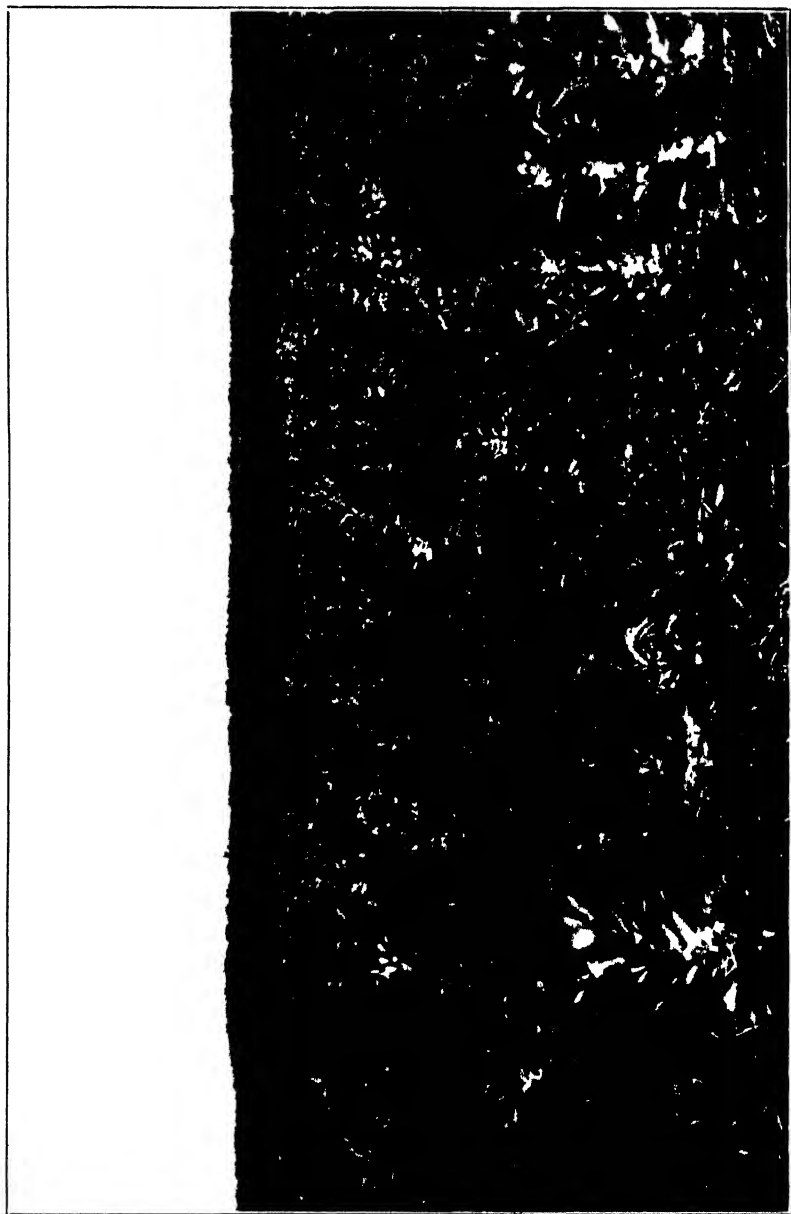


FIG. 3. View of portion of Bean Crop affected by Stem Flyworm Disease
(Photograph Copied by Linda L. Turner)

STEM EELWORM DISEASE

symptoms of distortion. Affected plants are often swollen at the base of the stem, which frequently becomes markedly flattened. The stem, which is severely twisted, may be bent in several places and often falls to the ground as the pods develop. Such plants easily break off at ground level, especially if struck by the foot or by implements. Gradually the thin or bare patches increase in size. Fig 3 illustrates a portion of a badly infested crop and the conditions prevailing during early summer. The lower leaves tend to fall early and the pods may be distorted and small, with consequent reduction in the harvest of beans.

If the stems of such plants are split longitudinally it will be seen that the interior of the hollow stem is brown, and as the plant matures this brown pith becomes dry and powdery owing to the loosening of the cells of the pith. The discoloration of the pith, which begins at the base of the stem, may extend up the stem, in some instances almost to the tip of the plant. Microscopic examination of the brown tissue reveals the presence of large numbers of eelworms. It is worthy of emphasis that, as Bos stated, the mature bean straw carries enormous numbers of the parasites in the infective form in the pith. It is well known also that the infective form of the Stem Eelworm can remain quiescent for a number of years in dried plant material and be revived when moistened with water. Fig. 2 shows a portion of the base of the stem of a plant split longitudinally to show the browning of the pith; incidentally, the photograph also illustrates the severe bending of a badly affected plant.

The writers have not had the opportunity of observing in the field the earliest stages of eelworm invasion of individual plants, but observations have been made on experimental plants sown in early summer in soil containing infected material. From such observations it can be briefly stated that the eelworm enters the plant at the base of the stem just below ground level and invades the cortical tissue immediately beneath the epidermis. It would appear that the eelworms congregate in the pith as the outer tissues become woody and the whole plant matures. The lower leaves undergo infestation by way of the petioles, and eelworms have been recovered by dissection from the stipules, the petioles and from the leaflets, especially from the veins. The main veins of infected leaflets are swollen and frequently slight distortion of the leaflets takes place. It should also be noted that the

STEM EELWORM DISEASE

parasite may enter the stalks of the pods. The writers have recovered eelworms from the bases of dried pods collected from the stack.

Factors predisposing to Eelworm Attack. Severe attacks of Stem Eelworm disease in the bean crop are spasmodic, but it would seem not unlikely that slight attacks would be overlooked in the crop. During the past year an unusual number of cases of the disease occurred in the bean growing districts of East Yorkshire, and it is possible that climatic conditions may have favoured the increase of eelworm at the expense of the bean crop. Some of the more important factors that may determine the persistence of eelworm infection on the farm are dealt with below.

Rotation. The question of crop rotation is always a matter of prime importance in relation to the incidence of plant pests, and especially is this true of parasitic eelworms, which are notoriously difficult to combat by direct remedial measures. It is a common practice in Yorkshire to allow a period of four years to elapse between successive bean crops on the same field. The writers have encountered only one instance where severe eelworm injury occurred in widely separated bean crops on the same field, and in this case four alternative crops had been taken between the affected bean crops, which suffered in 1930 and again in 1935. The cropping of this field during this period was Beans, Barley, Seeds, Oats, Wheat, Beans.

Two instances observed in 1936 may be quoted. The first occurred in East Yorkshire on a farm on which according to the farmer no trouble had ever been experienced in the past. The cropping of the field had been Beans, Fallow, Wheat, Seeds, Oats, Beans. The bean plants first began to go off in late February, and the trouble spread so rapidly that the whole crop was ploughed in in June. The preceding oats were described as a full crop, so that it was difficult from the information available to describe this sudden failure of the beans as a legacy from an infested oat crop. In this connexion it should be mentioned that seed saved from this oat crop was sown on another portion of the farm, and careful inspection revealed no sign of eelworm injury. It should also be added that tick beans that were sown in the spring of 1936 in an attempt to fill in the thin patches succumbed to eelworm attack.

STEM EELWORM DISEASE

The second case is of interest in relation to the observations recorded by Ormerod and by Bos. The field of beans began to show the usual field symptoms in early March and one-half of the crop, which followed oats, was so badly affected that by late spring it was ploughed in. The rest of the field followed barley and was allowed to stand, although badly affected, and by late June carried extensive patches where complete failure occurred. The cropping history of the field was Oats, Beans, Roots, Wheat, Oats or Barley, Beans. Again the grower asserted that the previous bean crop taken in 1932 was healthy. Ormerod and Bos refer to a case of Stem Eelworm disease in beans following oats that had suffered badly from the eelworm, whereas in the same field, beans following barley, which is not susceptible, were intact. In the instance described by the present writers it seems obvious that very considerable infection was present in that portion of the field that had carried barley before the bean crop, and in fact the resultant harvest amounted to less than half the normal return. The theory that infested oats may play an important rôle in producing an outbreak of Stem Eelworm disease in the subsequent bean crop is perhaps strengthened by the writers' observations that an oat crop adjoining the affected beans, although from a distance appearing to be a good crop, revealed on closer inspection obvious signs of eelworm trouble, and this was confirmed by laboratory examination. The oat crop at harvest was considered to be a good one by the grower. It is certain, therefore, that slight eelworm attack in the oats in such farms may be easily overlooked by the grower, and that unknown to him an eelworm infestation may be maintained in this way and so provide the right conditions for a sudden outbreak of serious disease. Preliminary infection experiments have shown that under experimental conditions the oat strain of the Stem Eelworm is capable of infesting field beans, thus bearing out the inferences drawn from field observations.

Weed Hosts. Many weeds are listed by Goodey as hosts of the Stem Eelworm and the same writer⁶ has more recently referred with emphasis to the possibility that weed hosts may serve to maintain in the soil infection of strains of the eelworm capable of attacking cultivated crops. Certain workers, notably Hodson^{7, 8} in this country, have shown that this fact is true of certain weeds and certain specified cultivated plants. One of the present writers⁹ has recently published a note on the

STEM EELWORM DISEASE

occurrence of the Stem Eelworm on certain weeds growing in fields of infested oats and beans. These observations showed that infested specimens of the weed Cleavers, *Galium aparine*, occur commonly in association with the infested crops mentioned. It was also pointed out that this comparatively widespread occurrence of infested Cleavers plants among eelworm-infested beans and oats was highly suggestive that the weed and the cultivated crop were serving as hosts for the same strain of the eelworm.

Preliminary infection experiments have revealed that the Cleavers strain of the eelworm is capable of infesting the field bean just as the oat strain under similar experimental conditions is capable of transference to beans. These findings are of great practical significance and will be referred to later in the discussion on control measures. It should be noted that as an infested crop becomes depleted so the weeds have a better chance of survival in abundant numbers with the greater possibility of large numbers of susceptible weeds, like Cleavers, becoming infested by the eelworm.

Infested Debris and Ground-keepers. The presence of large numbers of eelworms in the bean straw has already been mentioned, and the usual practice of ploughing in a badly-infested crop only serves therefore to return to the soil an increased eelworm population whose chance of survival depends on the growth on the land of suitable wild or cultivated hosts. The growth of adventitious bean plants which spring up in the ensuing crop as a result of germination of seeds shed before and during harvest is a common phenomenon. Such plants are clearly potential reservoirs of infection and would tend to offset the value of a reasonable period of rest between successive bean crops.

Control. It has already been suggested that climatic conditions may play an important part in conjunction with the factors already discussed, in providing suitable conditions for the onset of a sudden widespread attack in the crop, provided that there is some degree of eelworm infection of the soil. In no instance of the disease in the writers' experience was there any cause to criticize the cultural practices involved in the growing of the crops, all of which made apparently normal growth during the early growing period immediately after sowing. It is only necessary to discuss briefly from the

STEM EELWORM DISEASE

point of view of prevention of eelworm infestation certain practical points that emerge from the foregoing account.

Rotation. A reasonable period of rest between successive bean crops is essential, and as far as Yorkshire conditions are concerned it would be considered under normal circumstances that the rotations are not seriously at fault in this respect, since a four-year rest is usually adopted. In spite of such a practice, however, severe attacks occur, and it is advised, therefore, that after a bad attack a longer period should elapse before the infested field carries another bean crop; one instance has already been quoted in which two bean crops were badly injured in spite of a four-year interval of alternative cropping. It is impossible from the information available to state with any degree of certainty the minimum period of time that should elapse after a bad attack in order to ensure freedom from infection in the next bean crop. Robertson¹⁰ has reported that Stem Eelworm disease of oats may occur with regularity in spite of a rest of three years from cropping with oats. The theory which seems to be established, that the oat strain of the eelworm is capable of infesting beans, adds greater difficulty to the problem of preventing trouble in the latter crop, and it should be remembered that oats usually fall immediately before beans in the rotation. If it is impossible to omit the cereal crop from the rotation, then it would be advisable after a bean crop has failed with the disease to omit oats from the cropping of the field for a full course of the rotation. Further, the question of the great chance of a slight attack on oats or beans being overlooked should always be borne in mind and any suspicion of such a contingency should be verified by expert examination.

Destruction of Weeds. The field observations and preliminary experiments already described have shown that Cleavers acts as a host for the bean strain of the Stem Eelworm. It is essential, therefore, that this weed should be exterminated as far as possible in hedgerows as well as in arable land, on which, in Yorkshire, Cleavers is becoming a very common weed especially in cereal and bean fields. The past season has favoured the increase of such weeds especially, since cereal crops have been seriously depleted by insect and other pests. It is of interest to consider the bearing of the rotation upon the question of weeds in relation to their capacity to maintain an eelworm infestation in the field. In the first case of Stem

STEM EELWORM DISEASE

Eelworm disease quoted (see p. 132) the cropping during the four years between the two infested bean crops was Barley, Seeds, Oats, Wheat. Such a preponderance of cereal crops without a cleaning crop would undoubtedly tend to foster the growth of weeds that may have been infested. In the two further instances described the bean crop is followed by a fallow crop and bare fallow respectively. Bare fallowing, which is an essential cultural practice on many lands, may tend to assist the eelworm to tide over the interval between susceptible cultivated crops by fostering the growth of susceptible weeds. One of the writers has already recorded the occurrence of infested Cleavers seedlings growing in the fallow shortly after the ploughing in of a badly-infested bean crop. This fact again emphasizes the real need for the extermination of Cleavers.

Destruction of Infested Material. Enough has been said to indicate the necessity of removing as completely as possible all infested plant material from the field. The practice of ploughing in a severely infested crop is obviously unwise, and it would be preferable to collect and burn on the spot all such sources of infection. Similarly, the bean straw harvested from an infested crop that carries enormous numbers of the eelworm should also be burnt.

Adventitious bean plants have also been referred to, and the destruction of these potential carriers of infection would help to minimize subsequent eelworm attack.

Acknowledgements. The writers desire to express their thanks to Mr. J. Manby for the photograph shown in Fig. 3.

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THE APPLE PITH MOTH

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FOR the last few years the Apple Pith Moth (*Chrysoclista atra* Haw.) has caused a good deal of damage locally in apple plantations in the south and east of England, and in the spring of 1936 its attacks were more serious and widely distributed in south Lincolnshire, Cambridgeshire, Kent and Hertfordshire.* The insect is a well known pest in Germany, Poland, Norway, Sweden, Denmark, Holland, and France,† and though the injury that it causes is usually only slight, there are records of severe attacks that have almost completely defoliated the apple trees. In Britain the insect was first recorded as a pest in 1855 by Stainton,‡ whose correspondent noted that it was "a most destructive little wretch in apple grounds". Since that time numerous observations on the habits of the insect and the nature and extent of its attacks have been collected by Ormerod, Theobald and Carpenter.

Injury. Injury by Apple Pith Moth can be easily recognized and identified. The caterpillars feed on the "pith" of shoots and fruit spurs, and in time completely destroy the interior woody tissue. The leaves of infested shoots wilt and later shrivel and turn brown, and the blossoms of attacked fruit spurs die before opening or the cluster of fruitlets perishes just after the fruit has set. Attack by Apple Pith Moth is in progress from late summer onwards, but the final destruction of infested shoots does not take place until May or June of the following year, when healthy leaves and shoots are making rapid growth and the trees are in blossom. The dead shoots and spurs are very conspicuous at this time of the year and the extent of the damage is easily seen. Besides the direct loss of crop caused by the reduction of the number of healthy spurs, the injury to the bark permits the access of fungi and bacteria to the plant tissue.

* *Monthly Summary of Plant Pests, Min. Agric.*, June and July, 1936.

† *Rev. Appl. Ent.*, 1916 and onwards.

‡ *Entomologists' Annual*, 1855.

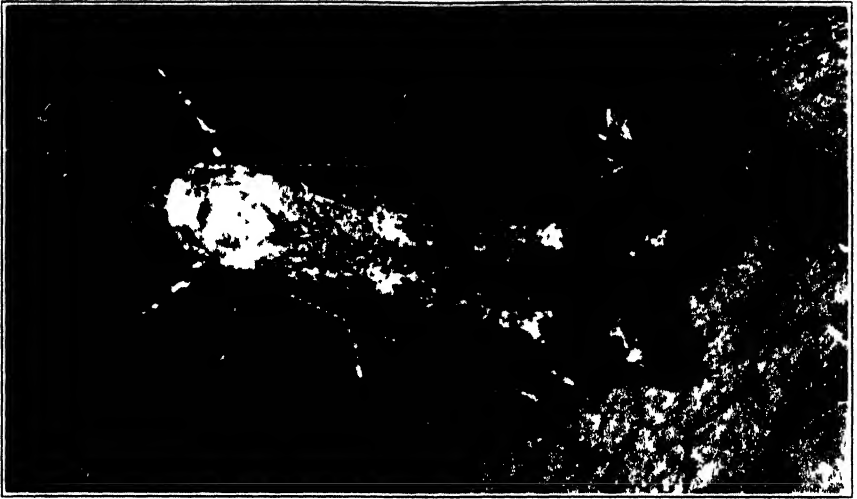


FIG. 1.—Apple Pith Moth. ($\times 16$.)

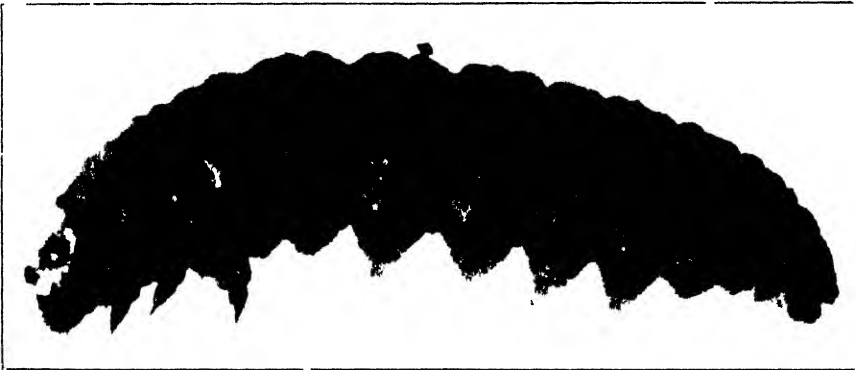


FIG. 2 - Caterpillar of Apple Pith Moth ($\times 7$)

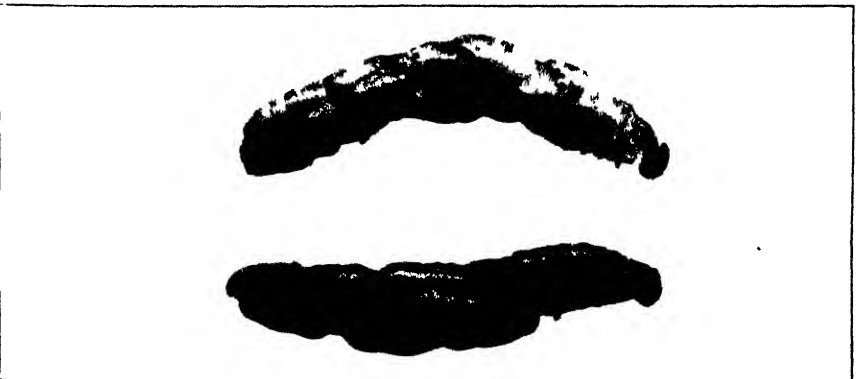


FIG. 3.—Caterpillar of Apple Pith Moth Destroyed by Parasitic Chalcid Wasp (*Copidosoma*).

(All photographs in this inset are Copyright by H. W. Miles.)

To face page 138.



FIG. 4 — Apple Branch with one healthy truss and one truss destroyed by the Caterpillar of the Apple Pith Moth



FIG. 5 Eggs of Apple Pith Moth ($\times 4$)

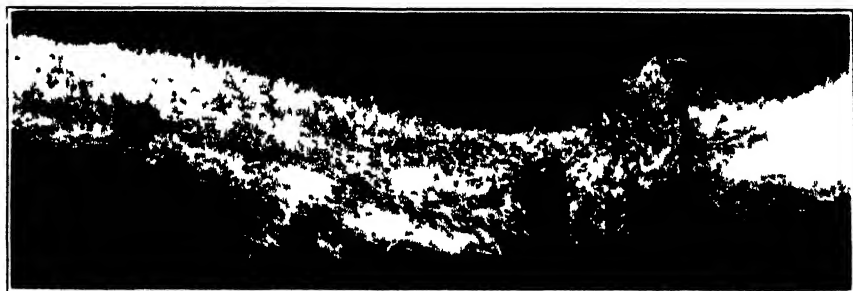


FIG. 6 Entrance Holes made by young Caterpillars in current year's shoot of Apple ($\times \frac{1}{2}$)

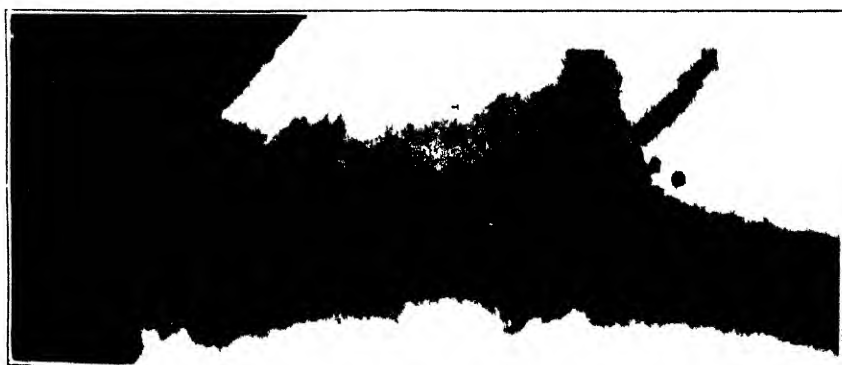


FIG. 7—Pupa of Apple Pith Moth in injured twig

APPLE PITH MOTH

Certain fungus and bacterial diseases may destroy the young shoots of apples in the spring, but it is not difficult to distinguish between injury by these organisms and that caused by the feeding of Apple Pith Moth caterpillars. Shoots killed by the caterpillars have the interior tissue eaten away and the cavity filled with dark brown powdery frass, and frass may also be found exuding from cracks or holes in the stem and the caterpillar or pupa may be present.

Most varieties of apples seem to be susceptible to attack by the moth. In Lancashire and Cheshire infested varieties include "Golden Spire", "Grosvenor", "Irish Peach", "Ecklinville Seedling", "Gladstone", "Worcester Pearmain", "Allington", "Bismarck", and "Grenadier". In a plantation in Hertfordshire "Worcester Pearmain" was highly susceptible to attack and "Newton Wonder" was practically immune, but in another part of the same plantation a sport of "Newton Wonder" was badly attacked. "Bismarck" and "Newton Wonder" were found to be attacked in Gloucestershire, and "Lane's Prince Albert" in Sussex. From Kent it has been recorded that "Worcester Pearmain" was severely infested while alternate rows of "Lord Derby" were not attacked, and that shoots and fruit spurs of "Cox's Orange Pippin" were destroyed.

Description and Life History. For some time the identity of the Apple Pith Moth was confused with that of a closely allied moth that feeds in hawthorn fruits, but in 1933 Fletcher and Stringer* made a careful comparison of type specimens with moths bred by the writer from both apple twigs and hawthorn fruits, and came to the conclusion that the pith moth of the apple is *Chrysoclista atra* Haw. The moth measures about half-an-inch across the expanded wings, and is blackish with a white head and faint light markings and prominent black scale tufts on the wings. When the moth is in a resting position the wings are folded over the back, and the light markings appear as three pairs of whitish areas: one pair in front of the first pair of scale tufts, the second pair at the base of the second pair of scale tufts, and a third pair near the tips of the wings. Extending along the middle of the wings from base to tip is a faint irregular band containing white and rusty yellowish

* *Entomological Record*, Vol. xlv, pp. 86-90.

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scales mingled with the black scales; this band varies in intensity in different individuals.

Observations in the north of England* showed that the moths emerged during July and were on the wing in fruit plantations during July and early August. It is possible that emergence is earlier in some seasons and in more southerly districts, since it has been recorded from France† that the moths emerge from June 6 to 23.

During the day the moths are inactive, but in the evening they may be found on the wing and are attracted to light.

The eggs are usually laid singly in the leaf axils or near the thickened base of the leaf stalk, and are present in northern fruit plantations from mid-July to mid-August. They are broadly oval, rounded at one end and somewhat truncate at the other, and with a thin, delicate shell sculptured by broken longitudinal ridges. When first laid the eggs are pearly white, but during incubation they become yellowish and later rather brownish. The incubation period as observed in northern England was two weeks, but in France† it was found that the eggs hatched in about a week.

When the caterpillars leave the eggs they are transparent greyish green, with large dark shining heads and long bristles. They wander about the twig for a short time and then tunnel into the bark, usually near the base of a leaf stalk. Within twenty-four hours after hatching they are generally completely out of sight in the plant tissue, and tiny entrance holes with fragments of rusty frass adhering near them may be found about the twigs. The caterpillars remain under the bark throughout the winter, and eat away the tissue, frequently killing buds in the vicinity of the feeding sites. In the spring, during May and early June in north England, the caterpillars become fully fed. They are then about one-third of an inch in length, dark brownish-pink in colour, and sparsely covered with long bristles. The head is dark brown and partly withdrawn into the thorax, which is covered by a dark brown thoracic plate, and there are three dark brown caudal plates at the tip of the body.

When ready to pupate the caterpillar makes its way towards the surface of the twig, usually near the terminal bud or just at the base of the blossom truss, and eats out a small circular hole through which the adult can escape. Pupation takes place

* Miles, M., *Ann. Appl. Biol.*, Vol xvii, 1930.

† Balachowsky, *Rev App Ent*, Vol xxiii, 1935.

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beneath the bark near the exit hole, but the pupa may sometimes be found projecting from the bark or among the flower stalks of the dead blossoms, or the breaking of an infested twig by the wind may leave the pupa exposed.

The pupa is rather less than a quarter of an inch long, and is golden brown with the head dark. The wings are long and narrow and the feelers extend beyond the tips of the wings. Near the tip of the abdomen is a pair of rather flattened tubular projections that bear a number of strong hooked bristles. The pupal stage lasts about a month.

There is only one generation in the year.

Control Measures. Since the caterpillars feed within the stems of the apple it is difficult to control them effectively by artificial means. The use of a lead arsenate spray during the summer when the caterpillars are hatching has been recommended, but the practical difficulties of covering the entire surface of the twigs at this season and the possibility of a deposit remaining on the fruit, render this method of control unsuitable. It has also been suggested that the creeping character of the tar oil and other winter washes should enable them to penetrate into the tunnels and destroy the caterpillars. In practice, however, it has been found that outbreaks may be very severe in plantations that have received routine applications of winter spray for many years; and observations of infested twigs have shown that it is only when the trees are making rapid growth, after the time for winter spraying is past, that the bark over the injured areas tends to crack and expose the feeding sites of the caterpillars.

The trapping of the moths during July and August in light traps has been recommended, and Theobald lists the Apple Pith Moth among insects captured at light traps in July in Kent. The use of light traps for pest control has not been tried extensively in this country, but where outbreaks are serious locally they might be used with advantage to reduce the number of moths.

Hand picking of the infested shoots is practicable in small plantations or in intensive apple plantations where all parts of the trees are easily accessible. The shoots should be destroyed immediately or kept in boxes closely covered with gauze that would permit the escape of parasites while retaining the host insects. Many of the parasites are small and would be able to escape through meshes one-tenth of an inch in

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diameter, and larger parasites can be easily separated since they are active in sunlight while the moths are at rest among the twigs.

The Apple Pith Moth is highly susceptible to the attacks of parasites. The large ichneumon flies, *Pimpla inquisitor* Scop. and *Ephialtes albispiculus* Morley, have been bred from grubs found feeding externally on the caterpillars. The most effective parasite, however, appears to be a small chalcid wasp, *Copidosoma woroniekæ* Now., which lays its eggs in the eggs of the moth. The writer has reared as many as 17 parasites from a single Apple Pith Moth caterpillar. This parasite is probably widely distributed, since it has been recorded from France and Poland, and in England from Kent, Lincolnshire and Hertfordshire. It is probable that the Apple Pith Moth is usually controlled naturally by its numerous parasites, and that its increase in the south and east of England in recent years is the result of some check on parasitism. Weather conditions or some other factor may have adversely affected the development of parasites and allowed the moths to increase beyond their normal numbers; or the parasites may have been automatically checked through lack of hosts after a period of increasingly effective parasitism, and may, in a short time, again become abundant and control the pest.

In infested fruit plantations the prunings frequently contain caterpillars of the Apple Pith Moth, and these may regain the trees unless the prunings are collected and burnt.

ACKNOWLEDGEMENT —Certain of the illustrations accompanying this article have already appeared in the *Annals of Applied Biology*, and the author is grateful to the Association of Applied Biologists for permission to reproduce them here

CATTLE INDUSTRY (EMERGENCY PROVISIONS) ACTS, 1934 TO 1936 :

NUMBERS, WEIGHT AND PRICES OF CATTLE CERTIFIED FOR PAYMENTS

In previous issues of this JOURNAL, information was given regarding the cattle and carcasses of cattle certified for payments under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936, during the first two years of the Scheme. Similar information is now available for the six months September, 1936, to February, 1937, and in this article the particulars for these months are set out on similar lines to those previously published and are compared with the data for the corresponding period a year earlier.

The classes of cattle in respect of which payments are made are steers, heifers and cow-heifers (a cow-heifer is defined as an animal which has calved and which has grown not more than six permanent incisor teeth). The standard of eligibility for subsidy is that the animal shall have an estimated killing-out percentage of not less than 54 per cent.

Table I shows the numbers of each class of cattle certified in the six months ended February 28, 1937, as compared with the numbers in the corresponding months a year earlier :—

TABLE I

	Steers		Heifers		Cow-Heifers		Total	
	1936-7	1935-6	1936-7	1935-6	1936-7	1935-6	1936-7	1935-6
September	72,527	74,581	66,912	63,248	5,490	4,521	144,929	142,350
October ..	72,753	77,652	70,455	65,826	5,400	4,558	148,608	148,036
November	68,970	66,745	70,295	60,529	5,272	4,702	144,537	131,976
Total : Sept. to November	214,250	218,978	207,662	189,603	16,162	13,781	438,074	422,362
December	72,635	74,896	65,050	58,539	4,659	4,410	142,344	137,845
January ..	78,735	83,831	57,696	54,066	5,872	5,663	142,303	143,560
February	81,508	85,380	50,248	47,629	5,638	5,423	137,394	138,432
Total : Dec. to February	232,878	244,107	172,994	160,234	16,169	15,496	422,041	419,837
Total : (6 months)	447,128	463,085	380,656	349,837	32,331	29,277	860,115	842,199

CATTLE INDUSTRY ACTS, 1934-1936

As has been pointed out in previous articles, the rate of marketing of fat cattle from month to month cannot be judged accurately from these figures, owing to the fact that the great majority of fat stock markets are held on the early days of the week; but useful comparisons are possible for three-monthly periods.

The number of cattle certified in the six months under review was 17,916 (or 21 per cent.) more than in the corresponding months of 1935-36, but the increase was mainly in the first three months of the period, the numbers certified in September to November showing an increase of 15,712, as compared with an increase of only 2,204 in the period December to February.

In the following statement the numbers of cattle certified each month have been adjusted in order to allow, as far as possible, for the fact that a large number of fat cattle markets are held on Mondays and that the number of markets held decreases day by day as the week proceeds. From these figures it would appear that the rate of marketing of eligible cattle in September, 1936, was higher than in September, 1935, by 0.9 per cent.; in October by 7.1 per cent.; in November by 3.5 per cent.; in December by 6.6 per cent.; in January by 3.5 per cent.; and in February by 0.2 per cent.

TABLE II

	1936-37 <i>No</i>	1935-36 <i>No</i>
September	142,287	141,030
October	152,841	142,713
November	143,213	138,418
December	137,238	128,763
January	149,218	144,232
February	148,440	148,139

Although the total number of animals certified showed an increase, the number of steers decreased by 2 per cent. in the three months September to November compared with the corresponding three months of 1935, and by nearly 5 per cent. in the three months December to February compared with the corresponding period of 1935-36. Heifers increased by 9 and 8 per cent. in the two periods respectively, and cow-heifers by 17 and 4 per cent. respectively.

In each month of the period under review the relative proportion of steers certified showed a decline of from 2.4 to 3.4 per cent. as compared with the same month a year earlier. The proportion of heifers and cow-heifers showed a corres-

CATTLE INDUSTRY ACTS, 1934-1936

ponding increase, but cow-heifers accounted for only about $3\frac{1}{2}$ to 4 per cent. of the total number of animals certified.

The following is a comparative statement of percentages of the different classes of animals:—

TABLE III

	Steers		Heifers		Cow-Heifers	
	1936-37	1935-36	1936-37	1935-36	1936-37	1935-36
	%	%	%	%	%	%
September	50.0	52.4	46.2	44.4	3.8	3.2
October	49.0	52.4	47.4	44.5	3.6	3.1
November	47.7	50.6	48.6	45.9	3.7	3.5
December	51.0	54.3	45.7	42.5	3.3	3.2
January	55.3	58.4	40.6	37.7	4.1	3.9
February	59.3	61.7	36.6	34.4	4.1	3.9

Live-weight Certifications. Animals certified at Live-weight Certification Centres accounted for 828,851 of the total of 860,115 animals certified at Live-weight and Dead-weight Centres in the six months September, 1936, to February, 1937. Details of the numbers of each class of animal certified at Live-weight Centres in each of the agricultural divisions into which the country is divided are given in Table IX (p. 150).

Table IV shows the numbers of animals certified at Live-weight Certification Centres in England, Wales, Scotland, Northern Ireland and the United Kingdom respectively in September, 1936, to February, 1937, compared with the corresponding period in 1935-36:—

TABLE IV

	September—November				December—February			
	1936-37		1935-36		1936-37		1935-36	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
England ..	282,922	67.1	268,783	65.6	260,806	64.0	254,663	62.3
Wales ..	28,632	6.8	26,765	6.5	26,034	6.4	26,913	6.6
Scotland ..	78,225	18.6	78,008	19.1	86,567	21.3	88,111	21.6
Northern Ireland ..	31,825	7.5	36,065	8.8	33,840	8.3	39,026	9.5
United Kingdom	421,604	100.0	409,621	100.0	407,247	100.0	408,713	100.0

CATTLE INDUSTRY ACTS, 1934-1936

The total number of animals certified at Live-weight Centres in the United Kingdom in the period September to November, 1936, exceeded the number certified in the corresponding period in 1935 by 2.9 per cent., but in the period December, 1936, to February, 1937, the number certified declined by 0.4 per cent. as compared with the corresponding period a year earlier. In England the numbers certified increased by 5.3 per cent. in the period September to November, and by 2.4 per cent. in December to February, while in Wales an increase of 7.0 per cent. in the first quarter was followed by a decline of 3.3 per cent. in the second quarter. In Scotland the numbers certified increased slightly in the period September to November, but fell by 1.8 per cent. in the period December to February. In Northern Ireland certifications declined by 11.8 per cent. and 13.3 per cent. in the two periods respectively.

In *England*, a comparison between the number of animals certified in the different agricultural divisions shows that in the three months September to November, 1936, the largest percentage increases were in the East Midland Division with 18.3 per cent., the North-Eastern Division with 11.8 per cent., and the West Midland Division with 7.2 per cent. Slight increases were also shown by the South-Western and Northern Divisions, but in the Eastern, South-Eastern, and North-Western Divisions there were small reductions.

In the three months December, 1936, to February, 1937, the East Midland Division showed an increase of 12.3 per cent. There were reductions of 4.7 per cent. in the Eastern Division and 6.5 per cent. in the South-Eastern Division, but small increases were shown in the remaining Divisions.

In *Wales*, in the period September to November, 1936, increases of 6.5 per cent. and 7.4 per cent. were shown in the Northern and Southern Divisions respectively. In the three months December, 1936, to February, 1937, the number certified in the Northern Division declined by 7.0 per cent., while there was practically no change in the Southern Division.

In *Scotland*, in the period September to November, 1936, certifications increased by 2.3 per cent. in the South-Eastern Division, and by 1.3 per cent. in the North-Eastern, and the Northern and North-Western Divisions compared with 1935, but small reductions were registered in the East Central and the Western and South-Western Divisions. In the period December, 1936, to February, 1937, reductions were shown in every Division, ranging from 1.1 per cent. in the East

CATTLE INDUSTRY ACTS, 1934-1936

Central to 4·3 per cent. in the Northern and North-Western Divisions.

Dead-weight Certifications. The total number of animals certified at Dead-weight Certification Centres in the six months September, 1936, to February, 1937, was 31,264, compared with 23,865 in the corresponding period of 1935-36, an increase of 31 per cent. Comparative particulars for each country are given in Table V, which shows that the increase was relatively larger in Scotland, with a rise of 69 per cent., than in England and Wales with a rise of 21·7 per cent.

TABLE V

	England and Wales		Scotland		Great Britain	
	1936-37	1935-36	1936-37	1935-36	1936-37	1935-36
September	3,570	3,343	1,381	663	4,951	4,006
October	4,475	3,336	1,557	968	6,032	4,304
November	3,833	3,419	1,654	1,012	5,487	4,431
Total: September to November ..	11,878	10,098	4,592	2,643	16,470	12,741
December .. .	3,354	2,297	1,180	525	4,534	2,822
January	4,368	3,553	1,053	827	5,421	4,380
February	3,747	3,233	1,092	689	4,839	3,922
Total: December to February ..	11,469	9,083	3,325	2,041	14,794	11,124
Total for six months	23,347	19,181	7,917	4,684	31,264	23,865

Average Weight of Fat Cattle. The average live-weight (after a deduction of 28 lb. had been made for subsidy payment purposes) at which fat cattle were marketed in the United Kingdom as a whole in the six months September, 1936, to February, 1937, was 9 cwt. 1 qr. 25 lb., which was 3 lb. lighter than in the corresponding period of 1935-36. The average live-weight for each of the six months was: September, 1936, 9 cwt. 0 qr. 25 lb.; October, 9 cwt. 1 qr. 4 lb.; November, 9 cwt. 1 qr. 16 lb.; December, 9 cwt. 2 qr. 26 lb.; January, 1937, 9 cwt. 2 qr. 14 lb.; and February, 9 cwt. 2 qr. 8 lb. The weights for September and October were respectively 21 lb. and 9 lb. less than the weight in the corresponding months a year earlier, but the weights for each of the remaining months were slightly heavier. From Table VI it will be seen that the cattle certified in the autumn and

CATTLE INDUSTRY ACTS, 1934-1936

winter of 1936-37 were lighter than in 1935-36 by 1 lb. in England and Wales, 17 lb. in Scotland, and 3 lb. in Northern Ireland.

TABLE VI

	Average weight over 3 months, September to November		Average weight over 3 months, December to February		Average weight over 6 months, September to February	
	1936	1935	1936-37	1935-36	1936-37	1935-36
	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.
England and Wales ..	9 1 11	9 1 16	9 2 24	9 2 20	9 2 3	9 2 4
Scotland ..	9 2 3	9 3 7	9 3 8	9 3 11	9 2 20	9 3 9
Northern Ireland ..	8 1 9	8 1 19	8 1 27	8 1 22	8 1 18	8 1 21
United Kingdom ..	9 1 4	9 1 15	9 2 10	9 2 12	9 1 25	9 2 0

The dressed carcass weights of the animals certified at Dead-weight Certification Centres averaged 614 lb. in the six months September, 1936, to February, 1937, as compared with 604 lb. in the corresponding period of 1935-36. There was little change in Scotland, but in England and Wales the average carcass weight was 9 lb. heavier in 1936-37, as will be seen from the figures in Table VII.

TABLE VII

	Average weight over 3 months, September to November		Average weight over 3 months, December to February		Average weight over 6 months, September to February	
	1936	1935	1936-37	1935-36	1936-37	1935-36
	lb.	lb.	lb.	lb.	lb.	lb.
England and Wales ..	596	593	617	602	606	597
Scotland ..	629	628	643	640	635	634
Great Britain	606	600	623	609	614	604

Average Prices of Fat Cattle. The average price per live cwt. of fat cattle certified in the United Kingdom in the six months September, 1936, to February, 1937, was 35s. 6d., as compared with 34s. 3d. a year earlier. It will be seen from Table VIII that in each month of the period under review prices showed some improvement on the previous year, the greatest increases being recorded in September and October.

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TABLE VIII

	England & Wales		Scotland		Northern Ireland		United Kingdom	
	1936-37	1935-36	1936-37	1935-36	1936-37	1935-36	1936-37	1935-36
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Sept. ..	35 6	33 4	39 0	36 4	32 4	29 4	36 0	33 8
Oct. ..	34 0	32 8	38 3	35 7	30 10	28 2	34 7	32 11
Nov. ..	33 2	32 5	38 4	36 6	29 10	27 7	33 11	32 9
3 months Sept to Nov. ..	34 3	32 10	38 7	36 1	31 0	28 3	34 10	33 1
Dec. ..	35 4	35 0	39 5	38 2	31 5	28 10	35 10	35 3
Jan. ..	35 6	35 2	38 9	38 0	33 1	30 9	36 1	35 5
Feb. ..	36 5	35 2	38 1	37 5	33 3	31 11	36 6	35 5
3 months Dec. to Feb. ..	35 9	35 2	38 8	37 10	32 9	30 10	36 2	35 5
6 months Sept. to Feb. ..	35 0	34 0	38 8	37 0	31 10	29 7	35 6	34 3

The average prices of dressed carcasses moved on similar lines, the average for the 6 months September, 1936, to February, 1937, being 62s. 6d. per cwt., as compared with 59s. 10d. in 1935-36. Details of average prices per cwt. dressed carcass weight where certification took place on a dead-weight basis are as follows:—

	1936-37	1935-36	1934-35
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
September	65 7	60 6	67 3
October	63 2	58 11	65 0
November	60 3	57 11	62 9
Three months, September to November	62 11	50 2	64 8
December	61 3	58 9	61 7
January	62 3	60 0	62 11
February	62 7	62 6	61 8
Three months, December to February	62 1	60 8	62 1
Six months, September to February	62 6	59 10	63 4

CATTLE INDUSTRY ACTS, 1934-1936

TABLE IX.—NUMBER OF CATTLE CERTIFIED FOR PAYMENT UNDER THE CATTLE INDUSTRY (EMERGENCY PROVISIONS) ACTS AT LIVE-WEIGHT CERTIFICATION CENTRES IN EACH MONTH FROM SEPTEMBER, 1936, TO FEBRUARY, 1937.*

Agricultural Divisions		Steers					Heifers						
		Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
ENGLAND (excluding Monmouth)	East ..	3,544	2,963	2,752	3,609	3,507	3,852	2,765	2,941	2,763	2,929	2,832	2,481
	North-East ..	7,008	6,314	5,480	5,908	9,522	11,608	2,703	2,765	2,618	2,375	3,000	2,798
	South-East ..	1,346	1,254	1,335	1,931	1,309	1,354	2,401	2,493	2,706	2,875	2,113	1,961
	East Midlands ..	9,208	9,541	8,989	8,290	5,826	4,491	9,134	9,439	10,237	8,389	6,286	4,638
	West Midlands ..	2,981	3,213	3,366	4,230	3,743	4,268	5,527	5,849	6,316	6,460	5,532	5,274
	South-West ..	3,727	3,657	3,147	4,326	3,007	3,651	5,604	5,645	4,933	5,763	4,746	4,285
WALES (including Monmouth)	North ..	7,228	8,858	8,494	7,535	11,354	11,838	12,348	13,879	14,104	10,695	9,126	7,766
	North-West ..	3,424	4,190	3,876	3,770	3,379	3,501	9,393	9,144	8,982	7,983	6,555	5,569
	Total ..	38,466	39,990	37,439	39,599	42,547	44,563	49,875	52,155	52,659	46,869	40,184	34,772
SCOTLAND	North ..	1,928	2,616	3,113	2,257	2,444	2,312	1,538	1,998	2,216	1,628	1,465	1,086
	South ..	1,014	1,983	1,978	2,190	2,006	1,880	2,681	2,937	3,039	3,164	2,621	1,909
	Total ..	3,542	4,599	5,091	4,447	4,450	4,192	4,219	4,935	5,255	4,792	4,086	2,995
NORTHERN IRELAND	North-East ..	3,968	3,793	3,624	4,730	4,432	4,414	4,371	4,241	3,894	4,688	4,532	4,493
	East Central ..	5,602	4,355	4,832	5,211	5,134	5,827	599	620	635	762	1,017	1,284
	South-East ..	4,330	3,932	4,043	4,792	4,711	5,083	295	306	388	510	383	329
	W. & S.-West ..	4,828	4,264	3,787	4,327	4,531	4,363	2,537	2,523	2,072	2,556	2,003	1,569
TOTAL UNITED KINGDOM	N. & N.-West ..	664	540	553	697	690	726	472	434	497	557	559	504
	Total ..	19,392	16,934	16,839	19,757	19,498	20,413	8,274	8,124	7,486	9,073	8,494	8,179
Total ..		8,242	7,995	6,730	6,393	8,988	9,210	2,796	2,793	2,549	2,498	3,119	2,863
Total ..		69,642	69,518	66,099	70,196	75,483	78,378	65,164	68,007	67,949	63,232	55,883	48,809

* Details of the monthly figures from September, 1934, to February, 1935, are given on pp. 144 and 145 of this *Journal* for May, 1935; from March, 1935, to May, 1935, on p. 467 of this *Journal* for August, 1935; from June to August, 1935, on p. 799 of this *Journal* for November, 1935; from September, 1935, to February, 1936, on pp. 148 and 149 of this *Journal* for May, 1936; and from March, 1936, to August, 1936, on pp. 784 and 785 of this *Journal* for November, 1936.

MARKETING NOTES

Milk Marketing Scheme. Pool prices and rates of producer-retailers' contributions for March, 1937, are given below, with comparative figures for February, 1937, and March, 1936. The monthly wholesale liquid milk price was 1s. 5d. in each of these months.

Region	Pool Prices			Producer-Retailers' Contributions		
	Mar. 1937 d.	Feb. 1937 d.	Mar. 1936 d.	Mar. 1937 d.	Feb. 1937 d.	Mar. 1936 d.
Northern	13½	14	12½	2½	2½	3½
North-Western ..	13½	14	12½	2½	2½	3½
Eastern	14	14½	13½	2½	2½	3½
East Midland ..	14	14½	13	2½	2½	3½
West Midland ..	13½	13½	12½	3½	2½	3½
North Wales ..	13½	13½	12½	3½	2½	3½
South Wales ..	13½	14	12½	2½	2½	3½
Southern	14½	14½	13½	2½	2½	3½
Mid-Western ..	13½	13½	12½	3½	2½	3½
Far-Western ..	13½	13½	12½	3½	2½	3½
South-Eastern ..	14½	14½	13½	2½	2½	3½
Unweighted Average	13·82	14·07	12·89	2·82	2·57	3·65

These prices are exclusive of any premiums for special services and level deliveries, and also of the Accredited producers' premium of 1d. per gal.

The number of producers who qualified for the accredited premium was 19,383 and the sum required for the payment of the premium was equivalent to a levy of 351d. per gal. on pool sales.

The inter-regional compensation levy was fixed at 1½d. per gal., compared with 2½d. per gal. in March, 1936.

Sales on wholesale contracts were as follows:—

	March 1937 (estimated) Gal.	March 1936. Gal.
Liquid	49,166,814	47,538,563
Manufacturing	20,281,962	26,511,974
	69,448,776	74,050,537
Percentage liquid sales ..	70·80	64·20
Percentage manufacturing sales	29·20	35·80

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The average realization price of manufacturing milk during March was 5·82*d.* per gal. compared with 5·72*d.* per gal. for March, 1936. The quantity of milk manufactured into cheese on farms was 547,080 gal., compared with 342,674 gal. in the previous month and 629,414 gal. in March, 1936.

Milk Acts, 1934 and 1936: Manufacturing Milk. Advances made by the Ministry up to April 15, 1937, in respect of milk manufactured during the financial years 1934-35, 1935-36 and 1936-37 are as follows:—

Section of Act		Quantity	Advances
	<i>Milk Marketing Board for England and Wales</i>		
1	In respect of milk : Manufactured at factories other than the Board's :	Gallons	£
	1934-35	152,711,544	996,053
	1935-36	206,976,659	977,546
	1936-37	151,585,133 (a)	212,984
2	Manufactured by the Board :		
	1934-35	846,293	5,924
	1935-36	1,727,369 (b)	6,926
	1936-37	(No claims received.)	
3	Made into cheese on farms :		
	1934-35	18,425,918	113,081
	1935-36	14,524,551	66,946
	1936-37	10,707,678 (c)	13,051
	Total for England and Wales	557,505,145	2,392,511
	<i>Government of Northern Ireland</i>		
6	In respect of milk : Manufactured into cream and butter at registered creameries :		
	1934-35	18,281,963	164,110
	1935-36	23,940,711	132,853
	1936-37	24,297,565 (a)	92,119
	Total	624,025,384	2,781,593

Gallage to end of (a) Feb., 1937, (b) Sept., 1935; (c) Dec., 1936.

Milk in Schools Scheme. The following figures show the gallonage of milk consumed in the first four months of the third year of the Scheme compared with the corresponding period in the first and second years. The figures for the third period will be slightly increased when further returns are received.

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	<i>Gallons</i>	<i>Exchequer Contribution</i>
October, 1934, to January, 1935 ..	8,367,873	
February to September, 1935 ..	14,485,307	
Total for 1st year	22,852,180	£401,861
October, 1935, to January, 1936 ..	7,689,042	
February to September, 1936 ..	14,209,194	
Total for 2nd year	21,898,236	£397,184
October, 1936, to January, 1937 ..	7,502,151	£171,925
TOTAL	52,252,567	£970,970

Cheese-Milk Price. For the purpose of payments under the Milk Acts (whether by the Exchequer to Milk Marketing Boards or by Boards to the Exchequer) in respect of milk used for manufacture, the cheese-milk price has been certified by the Minister and the Secretary of State for Scotland to be 5·36 pence per lb. for the month of April, 1937. No advances are, therefore, payable in respect of milk manufactured in Great Britain during April.

Wheat Act, 1932: *Sales of Home-Grown Wheat, Cereal Year, 1936-37.* Certificates lodged with the Wheat Commission by registered growers during the period August 1, 1936, to April 9, 1937, cover sales of 17,723,865 cwt. of millable wheat as compared with 27,726,795 cwt. in the corresponding period (to April 9,) in the last cereal year.

Suspension of Quota Payments. The Minister of Agriculture and Fisheries on the recommendation of the Wheat Commission, has made an Order, the Wheat (Quota Payments) No. 2 Order, 1937, (S. R. & O. 1937, No. 310) suspending the liability of millers and importers of flour to make quota payments under the Wheat Act. The Order came into operation on April 18, 1937, and remains in force until such time as a further Order is made by the Minister.

The making of this Order does not imply that no more deficiency payments are to be made to registered growers in respect of sales of home-grown millable wheat. Deficiency payments would only cease to be payable in respect of home-grown millable wheat sold in any cereal year ended July 31 if the ascertained average price of home-grown millable wheat for the year rose to approximately 10s. a cwt. The average price to date for the current cereal year is appreciably below that figure, and in accordance with previous announcements, the Wheat Commission made on April 17 an advance payment

MARKETING NOTES

to registered growers on account of deficiency payments for the current cereal year at the rate of 8*d.* per cwt. (equal to 3*s.* per qr. of 504 lb.) in respect of proper applications on valid wheat certificates delivered to the Commission up to March 18, 1937. The present Order of the Minister is based on a calculation that the surplus in the Wheat Fund as shown by the accounts for the cereal year ended July 31, 1936, together with the quota payments which have accrued since, will be sufficient to provide for deficiency payments in respect of the current cereal year and the other expenditure of the Wheat Commission attributable to that year.

The following table shows how the rate of quota payment has varied since the Wheat Act came into operation in 1932, and in particular how the rate has been reduced in recent months concurrently with the rise in the price of wheat.

<i>Date on which new rate of Quota Payment came into operation</i>	<i>Rate of Quota Payment</i>	
	<i>Per cwt.</i>	<i>Per sack of 280 lb.</i>
	<i>d.</i>	<i>s. d.</i>
June 19, 1932	10·8	2 3
October 30, 1932	13·2	2 9
August 2, 1933	16·8	3 6
November 5, 1933	21·6	4 6
August 12, 1934	19·2	4 0
March 17, 1935	21·6	4 6
September 29, 1935	19·2	4 0
November 3, 1935	16·8	3 6
February 23, 1936	14·4	3 0
August 9, 1936	9·6	2 0
November 1, 1936	4·8	1 0
January 27, 1937	2·4	0 6
April 18, 1937	(Quota Payments suspended)	

Sugar Industry (Reorganization) Act, 1936: Sugar Refining Agreement (Approval) Order, 1937. The Minister, after consultation with the Sugar Commission, and with the consent of the Treasury, has made the Sugar Refining Agreement (Approval) Order, 1937, dated March 22, 1937 (S. R. & O. 1937, No. 221), approving an agreement, which the British Sugar Corporation, Ltd., have entered into with other refiners of sugar making provision for the matters set out in the Third Schedule of the Act.

Cattle Fund. The following table gives particulars of payments made under the Cattle Industry (Emergency

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Provisions) Acts, 1934 to 1936, and shows the number of animals marked on importation into Great Britain :—

	April 1, 1936 to March 31, 1937	April 1, 1935 to March 31, 1936	*Sept. 1, 1934 to March 31, 1937
Payments	£3,982,728	£3,884,049	£9,880,084
Animals in respect of which payments were made ..	1,690,800	1,636,722	4,167,858
Average payment per animal	£2 7 1	£2 7 5½	£2 7 5
Imported animals marked at Ports (Great Britain only)	570,605	477,883	1,313,757†

* Commencement of subsidy payments. † As from August 6, 1934.

International Beef Conference. On April 8 the Board of Trade issued to the Press the following Notice regarding the appointment of the Chairman of the International Beef Conference :—

The Board of Trade announce that the Prime Minister has appointed Sir Henry Fountain, K.C. M.G., C.B., to be Chairman of the International Beef Conference. The object of this conference, which, it is hoped, will shortly be set up by agreement with the countries concerned, is to arrange for the regulation of supplies of beef to the United Kingdom from overseas.

Sir Henry Fountain was Second Secretary to the Board of Trade at the time of his retirement from the Civil Service in 1935.

Fat Stock: Carcass Sale by Grade and Dead Weight. During the three months ended March 31, 1937, 3,676 cattle, 5,465 sheep and 2,490 pigs were dealt with under the Grade and Dead-weight Scheme, as compared with 2,792 cattle, 7,000 sheep and 2,509 pigs during the first three months of 1936.

In the period under review, prices for fat cattle and sheep rose substantially.

National Mark Beef. During the three months ended March 31, 1937, 100,417 sides (73,842 home-killed and 26,575 Scotch-killed) were graded and marked with the National Mark. The number of sides marked was 3,057 in excess of that for the corresponding period of 1936.

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National Mark Cider Scheme. Evidence of the satisfactory progress of this scheme is afforded by the returns of the output of National Mark Cider during the year ended September 30, 1936. These show an output for that year of over 2,400,000 gal., which compares favourably with the total figures of 2,216,000 gal. and 1,781,000 gal. for the years 1934-35 and 1933-34 respectively. The output of cider under the National Mark for each of the three preceding years was less than 1,000,000 gal.

The National Mark when applied to cider is not only an assurance to the consumer that the cider satisfies specific requirements as to quality, but it enables him to identify a beverage that is produced solely from fruit grown in England or Wales.

National Mark Cheese Schemes. The year 1936 was one of expansion with respect to National Mark schemes for cheese. At the opening of the year schemes for Cheshire, Stilton, Caerphilly, Cheddar and Cream cheese were in operation, although the three last-mentioned schemes had been but lately introduced. During the year, in addition to the efforts directed to secure the development of the older schemes and the firm establishment of the newer schemes, further schemes were introduced for Lancashire, Leicester, and Wensleydale cheese, while preliminary steps were taken to set up a scheme (since brought into operation) for Derby cheese.

Changes of some importance were made in the arrangements for grading under the Cheshire cheese and Caerphilly cheese schemes. As regards the former the grading arrangements under the original scheme were undertaken solely by the Cheshire Cheese Federation. In March, 1936, however, the newly-formed Association of National Mark Cheese Manufacturers took over this responsibility with respect to creamery-made Cheshire cheese, while the Federation retained their responsibility with respect to the grading of farmhouse Cheshire cheese.

As to the Caerphilly cheese scheme, the grading of the cheese was carried out originally by each packer with respect to his own output. At the instance of the packers themselves, however, a Grading Committee was set up to control the grading and appoint official graders to carry out the duties.

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Particulars of the total output of cheese under each of the schemes for the year 1936 are as follows:

<i>Type of Cheese</i>	<i>Number and Weight of Cheese Graded</i>	
	<i>Number</i>	<i>Weight cwt.</i>
Caerphilly	371,301	—
Cheddar	9,519	4,524½
Cheshire—		
(a) Farm made	108,645	32,970
(b) Creamery made	102,633	38,681
Cream	19,362*	18½*
Lancashire	35,893*	12,740*
Leicester	681*	217*
Stilton—		
(a) Blue	11,105	1,377½
(b) White	18,538	2,824½
Wensleydale	9,157*	592*

* Scheme in operation for part of year only.

At the end of 1936, 329 farmhouse and creamery makers of cheese were enrolled in the National Mark cheese schemes as follows: Caerphilly 18, Cheddar 17, Cheshire 251, Cream 2, Lancashire 19, Leicester 4, Stilton 13 and Wensleydale 5. The general position appeared to justify the conclusion that a steady increase of the total number of packers might be anticipated.

Marketing Demonstrations at Agricultural Shows. The Ministry will stage exhibits at the following agricultural shows this summer:—

- Oxford County—Banbury—May 18-19.
- Devon County—Paignton—May 19-21.
- Bath and West—Trowbridge—May 26-29.
- Royal Counties—Reading—June 2-5.
- Suffolk County—Beccles—June 3-4.
- Three Counties—Hereford—June 8-10.
- Essex County—Maldon—June 9-10.
- Lincoln County—Spalding—June 16-18.
- Northampton County—Kettering—June 23-24.
- Aldershot—Aldershot—July 1-3.
- Royal—Wolverhampton—July 6-10.
- Great Yorkshire—Knavesmire, York—July 13-15.
- Kent County—Canterbury—July 14-16.
- Royal Welsh—Monmouth—July 21-23.
- Royal Lancashire—Withington, Manchester—July 29-Aug. 2.

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Sandy and District—Sandy—Aug. 26.

Southport Flower—Southport—Aug. 25-27.

The Ministry's exhibits this year will be designed to appeal particularly to the producer. Working demonstrations of the testing and grading of eggs, fruit or other products will be staged, and at the Suffolk, Lincoln, Royal, Great Yorkshire and Royal Lancashire shows live cattle, sheep and pigs will be exhibited to illustrate the various types of animal expected to yield carcasses of the grades defined under the Ministry's Scheme for the sale of livestock by Dead Weight and Grade.

Livestock Industry Bill. Service Schemes. The April, 1937, issue of this JOURNAL contained statements made by the Minister in explanation of Part IV of the Livestock Industry Bill, dealing with livestock markets, and Part V, relating to slaughtering. The following extracts from statements made by the Minister in the House of Commons and in Standing Committee give a general indication of the intention and scope of Part VI of the Bill, relating to Service Schemes.

This part of the Bill was amended in Standing Committee in order (as indicated by the Minister in his statement) to give greater precision to the purposes for which Service Schemes could be used.

In the Second Reading on January 20, the Minister said: "On Part VI of the Bill, which relates to service schemes, I need not say a great deal. The purpose we have in view is to provide some means by which all sections of the industry can co-operate, either jointly or severally or nationally or locally, in order to carry out schemes of service to the industry. I have given the example of advertising. I would emphasize that this part of the Bill is purely enabling legislation; it enables those who desire any sort of service to co-operate effectively for the purpose. How far it is made use of will depend, of course, upon the initiative, the ingenuity and the needs of those who might be helped by the proposals."

The Minister, in Standing Committee on April 8, moved the following sub-clause:—

(1) On the request of any body or bodies appearing to the Commission to be substantially representative of the interests of any class or classes of persons engaged in one or more of the following activities, that is to say, the production, marketing and slaughtering of livestock and the preparation for sale, and the marketing, treatment, and use, of products of the slaughtering of livestock, the Commission, if they consider, after consulting the Livestock Advisory Committee and any

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other bodies appearing to the Commission to represent the interests of the said class or classes of persons, that it is expedient so to do with a view :—

(a) to the promotion of efficiency or economy in the production, marketing or slaughtering of livestock or in the preparation for sale, or the marketing, treatment or use, of such products as aforesaid, or to increasing the demand for livestock or such products as aforesaid, and

(b) to the encouragement and promotion of co-operation between such persons as aforesaid, may make and submit to the appropriate Minister a scheme for the performance of services for one or more of the following purposes, that is to say :—

(i) the encouragement, promotion or conduct of research and education in matters affecting any of the said activities ;

(ii) the collections and dissemination of statistics and other information relating to the marketing of livestock or products of the slaughtering of livestock ;

(iii) the insurance of livestock ;

(iv) the advertisement of livestock or products of the slaughtering of livestock ;

(v) the grading or marking of livestock or carcasses ;

(vi) the compensation of persons for any loss or damage which they may suffer by reason of the operation of this Act or any instrument having effect by virtue of this Act, the indemnification of persons in respect of their liability to contribute under any livestock markets order, or the making of contributions to the Commission for the purpose of defraying expenses incurred by them in respect of such compensation as aforesaid ;

(vii) any purpose similar to any of the purposes mentioned in paragraphs (i) to (vi) of this sub-section.

Any such scheme as aforesaid is hereafter in this Act referred to as " a service scheme."

He said : " I would like the Committee to know, and I like to know myself, precisely what I am enacting. For that reason I have used the more precise language which appears in the new draft which I am now submitting."

" In the first place, some hon. Members might like a service scheme to come into operation to carry out some of the regulatory functions which are commonly associated with the operation of the Agricultural Marketing Acts. Some hon. Members might think it desirable that a service scheme should be put into operation in an area covered by a livestock markets order, so as to regulate the supply of cattle to the various markets within that area. There is no doubt that that activity is excluded from the content of service schemes, by the wording which I am now proposing. The reason why, after a great deal of deliberation and anxious thought, I have come to the conclusion that it is wise to exclude those activities from service schemes is that they are properly the subject of the

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procedure of the Agricultural Marketing Acts. The Bill as drafted, both before this Amendment is approved and with it, allows ample scope for the operation of a producers' board under the Agricultural Marketing Acts to dovetail into the structure which this Bill sets up."

"I can quite conceive of some hon. Members thinking it desirable that we should take this short cut of the service scheme in order to put into operation some of the regulatory functions of the Agricultural Marketing Acts, without the cumbersome machinery necessarily associated with the operation of those Acts, but I will tell the Committee the reason which weighed my opinion down against such a course. I say this with no closed mind but with a desire to hear what hon. Members think of it. The reason which influenced me to exclude what I might call Agricultural Marketing Act activities from service schemes was that in those Acts where the power is given to a producers' board to carry out certain functions, Parliament, in its wisdom, very properly attached to those powers a system of control in the public interest: that is to say, committees of investigation and also, of course, the democratic constitution of the marketing scheme which enables those concerned in production to express their own vote on the desirability or not of the element of coercion which is implied, and necessarily so, in a marketing regulatory scheme."

"There is a second form of activity which hon. Members might also wish to see possible under the service schemes, and that is the trading activity. I tell the Committee, so that they may know exactly what they are deciding, that under the new draft of Clause 31 which I am proposing this activity is also excluded. I can conceive of hon. Members thinking that those concerned with the operation of this Bill and those affected by its provisions might desire to use this part of it—the operation of service schemes—in order to set up some subsidiary trading activity under a service scheme which would be ancillary to the operation of the Measure and would perhaps be of benefit. That is another matter which the Committee have to decide. I have given the suggestion careful consideration, and I have been influenced against it, in the main, by this consideration: The position is that under the law of the land any group of persons can always combine and incorporate themselves as a joint stock company, or under the Industrial and Provident Societies Acts, for trading

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activities of this character. I feel that if one were to have a trading activity under a service scheme, it would be more of the nature of a commercial venture than a service scheme."

"Again, there is this difficulty about promoting trading activities under a service scheme: If a group of persons come together, either under the joint stock procedure of the Companies Acts or under the Industrial and Provident Societies Acts for the purposes of trading, the rights of the contributors to the trading venture are jealously guarded by the Acts in question. If we were to extend the operation of service schemes to introduce an element of compulsion into some trading activity there would be the danger that the same jealous supervision over the individual rights of contributors to the commercial venture might not be exercised. It is for that reason that I have sought to define the purpose of the Clause in this way. The object is to remove uncertainty. The questions which I have discussed, namely, the desirability or otherwise of promoting regulatory or trading functions to be exercised under this Part of the Measure are questions of policy on which I shall be glad to have the advice of hon. Members. As I say, my mind is not closed on the subject, though, for the reasons I have given, I believe that the exclusion of these activities from service schemes would leave the character of the service schemes clearer from confusion and would, on the whole, be desirable....."

"I should not like the Committee, however, to part with this matter under the misapprehension that the Amendment effects that radical change in initiative and in emphasis which some hon. Members appear to suppose. The matter has been discussed by some speakers as if it were a matter of principle and as if this were an inquiry into which method of organization was the better—the Agricultural Marketing Acts method or the Commission method..... Apart from the doubt as to whether those activities would be legally possible under a service scheme, there is no power of coercion involved here at all. If you proposed to use this Part of the Bill in order to get a regulatory marketing scheme, you would have to add to it the pains and penalties which are in the Agricultural Marketing Acts for those who transgress the provisions of schemes under those Measures....."

"There is no power for one interest to coerce another, but what is anticipated is that two classes of persons may have some interest in common, such as better display or more

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accurate descriptions, and may choose to come together and submit a joint scheme, and it is considered that provisions should be made accordingly.....”

“ No one can accuse the agricultural population of any unreadiness to co-operate and to use to the full the opportunities given them by the Agricultural Marketing Acts. I think the same will be true of this Part of the Bill. I believe it to be a delusion that those who live on the land and gain their living by agriculture are behindhand in intelligence and enterprise as compared with the people in the towns. In some ways they are closer to nature, and the great changes that have taken place in the agricultural industry in recent years show the readiness of the people concerned in it to adopt new methods, even though they may seem revolutionary to them at the time. I believe that by giving them power under this Part of the Bill to combine for these purposes, they will make use of it and work this Part of the Bill to the advantage of themselves and of the industry in which they are engaged.”

Conclusion of Committee Stage. The Standing Committee of the House of Commons, which has been considering this measure, concluded their deliberations on April 13, when they agreed that the Bill, as amended should be reported to the House. The Committee sat on 18 days.

MAY ON THE FARM

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THE present month sees the end of the winter season as far as live stock are concerned, horses, cattle, and sheep on by far the majority of farms having left their winter quarters and finding all, or the greater part of their food, from pasturage. On mixed farms any labour freed from the work of attending to stock will be most welcome for assisting in getting in arable crops. The continuance of wet conditions right into April has delayed cultural operations and the getting in of spring sown crops is now a matter of great urgency on many farms.

As the season advances soils dry out more rapidly during dry spells, and there is need for special care in the management of cultivations; this is particularly so on strong clay land, and a season like the present affords ample scope for the practice of the "art of cultivation". To do the right thing just at the right time is often essential to obtain the necessary conditions for a good seed bed. To obtain tilth and retain moisture may be no easy matter when it is necessary to prepare strong land during dry weather after it has been waterlogged. If dry weather intervenes during May, how welcome "May showers" may be, and how much labour can be saved if they come at the right time.

Pasture Land. The cold weather in early April checked the normal growth of pastures, but a few days of favourable weather can soon make great changes in the availability of grass kept for stock. It is important, especially with high-yielding cows, to ensure that they get enough food, and if there is a shortage of pasture adequate compensation should be given in the way of concentrates.

On large areas of grass land the pleasing sight of rich, green and luscious grass that we usually find at the end of April and the early days of May, soon begins to be marred by the appearance of the common Creeping Thistle. This weed is

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very widespread in most districts and has definitely increased in recent years. It has been shown in the north of England that, if the thistles are cut when from four to six inches high, and again, when necessary, six weeks later, for two or three successive years, they can be practically eradicated even on badly infested areas. Where the thistles are left until the middle of August and the stems have become well matured, the same results are not obtained, the thistles continuing to appear in following years, when they will be both numerous and vigorous. The principle to bear in mind is that it is necessary to prevent the plant from utilizing its leaf-system for any length of time for the elaboration of food that it can store up under ground for the following season. When the thistles are cut in the early stages of growth the roots of the plants are prevented from storing up more food and are reduced in vigour, and in time succumb. Good hand cutting has proved most effective, but it is more expensive than machine cutting. It is unfortunate that on most farms pressure of other work frequently makes it difficult to tackle this problem in the vigorous manner that is needed if success is to be obtained, but on many grass farms the question could receive more attention. It is satisfactory to note that many farmers are now tackling this pest in a more effective manner.

Meadow Land. Yellow rattle or hen-penny (*Rhinanthus crista-galli*) is responsible for a great deal of loss in weight of hay on much of our permanent meadow land. The plant itself is practically worthless as a food, and is semi-parasitic on the roots of grasses, resulting in reduced growth and a light hay crop. The plant begins to show itself towards the end of April and beginning of May; it persists, because it is an annual and seeds before the normal period for cutting the hay crop. Various ways of reducing the loss from this troublesome weed are recommended; at Cockle Park in 1916 on land badly infested, the crop was cut earlier than usual, just before the seeds of the weed had become ripe; a reduced hay crop was obtained in that year but in the following year very few yellow rattle plants were seen on the earlier mown portion of the field, while they continued in large numbers on the area cut at the normal period. A hay crop of at least 5 cwt. or more was harvested from the early-cut portion in 1917. The grazing of a meadow for two or three years will give the

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same result, as the weed does not do well on land that is grazed and trodden by stock. On farms where liberal quantities of farmyard manure are available, liberal dressings of farmyard manure applied early and light grazing in spring allow the grasses to compete successfully with the young yellow rattle plants, and in this way have the effect of preventing them becoming established and producing seed. Early mowing of meadow hay fields often has the advantage of reducing other weeds and thus giving a larger proportion of grass and clover.

Sheep. The anxiety of the lambing season is practically over except on some of the late hill farms. Amongst lowland flocks the percentage of lambs born appears to have been satisfactory, but on the average it would seem that losses have been heavier than usual, particularly on higher lying exposed farms. During April many complaints were heard of lambs not doing well. Young grass has been in short supply and it is very difficult to make adequate compensation for this valuable foodstuff in the diet of a milking ewe.

It will not be long before the flockmaster is concerned with maggots and similar troubles. Care in keeping ewes and hogs properly trimmed may do much to mitigate the evil as well as reduce losses from wool ball in lambs. In a season like the present, with a wet, late spring followed by rapid growth of succulent pasturage, there is a greater liability to scouring. The feeding of a low protein food like maize or a binding food like undecorticated cotton cake may check this tendency.

In recent years there has been a tendency on many farms to overstock with sheep. There are several reasons for this, the more important being the relatively better returns from sheep feeding than from fattening cattle, and the improvement of much of the poorer pasturage by manurial treatment, especially with phosphates, involving increased stocking.

The truth of the old saying "a sheep's worst enemy is another sheep" has been amply demonstrated. Change of pasturage and as wide a distribution as is practicable are desirable. On sheep pasturage where there is a tendency for the herbage to become strong and send out flowering stems at a comparatively early stage, it is most desirable to graze a fair proportion of cattle. Cattle stock have not the same powers of discrimination in grazing, and make possible a

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much more even grazing of the sward. Where pasture plants are allowed to run to seed, the deterioration is rapid, both in quality and digestibility.

Poultry. Unlike certain other farm stock poultry are dependent upon direct feeding of concentrates, so that with the advent of the grass period the poultry keeper gets little relief from the expense of purchased concentrated foods. It is particularly important, with the present high prices of food-stuffs, that there should be efficient management, and the poultry keeper should only retain birds that are likely to give a return for food consumed.

During May there is still some demand for boiling fowls, and any birds of this type that are saleable should be disposed of before large numbers of cockerels appear on the market. The hatching of heavy breeds will be finished and chicks should be making good growth. The rate of growth for a batch of young chicks at this time of year is rapid, and it is important that they should receive a sufficient allowance of suitable food, supplying sufficient protein and minerals, as the foundation of the future laying hen is being laid down at this time.

A continuous watch should be kept on the flock for any signs of disease, as, especially with poultry, disease may spread so rapidly. On many farms Coccidiosis takes a very heavy toll of chicks. It should be borne in mind that this disease is controllable, and if the poultry keeper is not conversant with the symptoms or methods of control it is most advisable that, at the first signs of trouble amongst the young birds, the advice of an expert should be obtained—County Poultry Instructors can give much useful information and advice that may be most valuable in preventing serious loss.

Horses. The last two or three years have seen a revival of interest in horse-breeding. During the last two years prices have been higher, and at present they are very satisfactory. The present month sees the height of the breeding season. Losses amongst foals from joint-ill are more numerous than necessary on many farms. Inoculation does much to reduce this loss; and on farms where the trouble is known to occur it is wise to consult a veterinary surgeon a few weeks before the mare is due to foal.

Breeding results with horses are less satisfactory than with

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other classes of other farm livestock. How often we find the foaling return as low as 55 per cent. and how seldom over 70 per cent. This means considerable loss, as service fees are high and very often valuable breeding mares produce too few offspring. The risk of the mare not producing a foal, often makes breeders obtain the services of cheaper sires. This is usually false economy, as the saving of one or two pounds in service fee is not much compared with the sum total of breeding expenses, while the resultant progeny may be of much less value. The system of travelling horses on a weekly round, and it is not easy to avoid this, is no doubt a factor that contributes greatly to the poor foaling returns, as mares are not always mated at the most favourable time—which is towards the end of the heat period.

Cereal Crops. Spring corn frequently shows signs of trouble from grub attacks during this month. Wireworms, and on oats after temporary or long leys, leather jackets, may attack the roots, destroying many plants or checking growth of others. Frit fly, the grub of which attacks the centre growing shoot in the stem, often cause considerable loss to oats especially those sown late. Remedial measures are not easy; but generally speaking anything that helps the plant to make rapid growth is an advantage. Top-dressing with quick-acting nitrogenous fertilizers, such as nitrate of soda, nitrate of lime or nitro-chalk, may do much to reduce loss from such pests. Rolling on light soils or newly-ploughed-out grass land also helps in producing firm conditions for the root system.

Charlock is responsible for a great deal of loss in some areas. Various methods of getting rid of the weed are recommended. Dry and wet sprays give satisfactory results when weather conditions are favourable. Finely-powdered Kainit does well, and on light soil short of potash, may be a useful manure in addition to destroying the weed. On soils where nitrogen can be applied without risk of lodging, dusting with calcium cyanamide may be recommended. Sulphuric acid and copper sulphate solution may be used as a wet spray. Farmers are advised to consult their County Agricultural Organizer as to form and method of application for their particular conditions.

One often hears that on certain fields or farms barley seldom does well. Further inquiry usually reveals the fact that these fields are deficient in lime. Barley is the least tolerant of all

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cereals to acidity. It is satisfactory to note that more attention has been given to the question of liming during recent years. There is still room, however, for greater attention to this question. The good results from the applications of suitable dressings of lime on acid soils, where finger-and-toe occurs in swedes, cabbage, kale, etc., and also in helping clovers, barley, etc., are well recognized, but during recent years experiments have shown that for crops regarded as tolerant to acidity, such as potatoes and oats, applications of lime have given good results.

Wherever crops are found to be showing signs of unsatisfactory growth an effort should be made to determine the reason. The Agricultural Organizer for the county is always willing to give assistance, and, if necessary, will take samples of soil for analysis.

NOTES ON MANURING

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Trends in Fertilizer Consumption. A comparison of annual fertilizer consumption in terms of the actual plant nutrients contained in the fertilizers discloses some interesting changes. *Total* consumption of fertilizer, and the selection of the form in which any particular plant nutrient shall be purchased, are obviously influenced by such factors as world trade, financial conditions in the agricultural industry, and the relative price of different fertilizers.

Changes in the *ratio* of the different plant nutrients consumed, however, cannot be so readily explained. Doubtless such changes are influenced to some extent by the spread of knowledge based on the accumulated results of research and experimentation. Other factors, however, obviously exert a very considerable influence on fertilizer consumption in any particular country, especially in times such as the present, and in countries that produce one type of fertilizer but have to rely almost entirely on imports for supplies of some other plant nutrient.

TABLE I

ESTIMATED FERTILIZER CONSUMPTION IN GREAT BRITAIN AND IRELAND—
RATIO OF PLANT NUTRIENTS CONSUMED

<i>Year</i>	<i>Nitrogen</i> (N)	<i>Phosphoric Acid</i> (P ₂ O ₅)	<i>Potash</i> (K ₂ O)
1913-14	.. 1	4·3	1·2
1922	.. 1	4·5	0·5
1926	.. 1	3·7	1·1
1927	.. 1	3·9	1·3
1928	.. 1	3·9	1·2
1929	.. 1	4·3	1·2
1930	.. 1	3·9	1·0
1931	.. 1	3·4	1·1
1932	.. 1	2·4	0·7
1933	.. 1	2·4	*
1934	.. 1	2·7	1·1

* Data not available

Table I shows the relative estimated amounts of nitrogen, phosphoric acid and potash consumed annually in Great Britain and Ireland for a number of seasons during the period 1913-1934. The figures are based largely on data published

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by A. N. Gray in the *Empire Journal of Experimental Agriculture* (1934, II, 64), in *Superphosphate* (1936, No. 6, and 1937, No. 2), and in the *Journal of the Royal Agricultural Society* (Vols. 93-95).

The figures in Table I indicate that a considerable reduction has taken place in the proportion of phosphoric acid used during the 20 years 1913 to 1933—the change being particularly rapid during the years 1930 to 1933 inclusive. Whether such reduction could go still further without causing losses in crop yields is not easy to decide, since there is really little experimental evidence available as to the cumulative effects of using different proportions of the various plant nutrients. On the other hand, it is possible that by 1933 the reduction had already gone too far and the small increase shown in 1934 may be the first indication of the appreciation of this fact by the farmer. It will be interesting to see whether the figures for 1935 confirm this reversal of the downward trend in the relative consumption of phosphoric acid.

It should be noted that the reduction in the ratio of phosphoric acid to nitrogen used was not simply due to the total consumption of phosphoric acid remaining constant whilst that of nitrogen increased. Omitting the War years, there has been a fairly steady increase in the total consumption of nitrogen (except for the year 1931), but the total consumption of phosphoric acid has actually fallen considerably over the same period, though the year 1929 saw a temporary "peak" consumption which was reflected in a temporary increase in the ratio of phosphoric acid to nitrogen, despite the fact that nitrogen consumption also showed a large increase in that year. In 1934, however, the total consumption of phosphoric acid showed an increase over the previous year, and it may be that the pendulum is beginning to swing in the opposite direction and both total and relative consumption of phosphoric acid may now be rising again.

During the period 1913-33 world fertilizer consumption showed a similar trend towards a lower phosphoric acid ratio. In France and Germany the proportion of phosphoric acid to nitrogen has for long been below that in this country. The continued use of such a low proportion of phosphoric acid, however, has been criticized in recent years by German investigators, who point to the low cereal yields in Germany during the Great War and the years immediately following the War, when phosphoric acid supplies were very low. They

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suggest that it may also be responsible for the increase in a variety of cropping troubles in their country in more recent years.

Earlier notes in this series have drawn attention to the serious effects of definite phosphate deficiency on crop yields in this country, and there is evidence that in some districts this condition has made itself felt in recent years. The slight rise in the ratio of phosphoric acid to nitrogen used in 1934, which was accompanied by a rise in total consumption of phosphoric acid, may therefore be a very desirable trend, though it would be unfortunate if it developed too strongly and caused the pendulum to swing too far in the direction of an unnecessarily high P_2O_5 : N ratio. On most farms too much money spent on one type of fertilizer usually means there is not enough left to purchase adequate supplies of other plant nutrients.

The potash : nitrogen ratio reached a peak value in 1927 and then declined steadily until the low value of 0.7 : 1 was reached in 1932. There was a definite rise, however, by 1934 when the ratio was not far short of that for the peak period 1927-29.

Unfortunately it does not seem possible as yet to state what is the most desirable ratio of plant nutrients, and so it is impossible to forecast the ultimate effect of any particular trend. Further experimental work on the cumulative effect of standard schemes of manuring seems the most likely way of obtaining this information. A change for only one year is not likely to be of any great significance or to have any far-reaching effect. Such a change is often due to a temporary rise or fall in the price of some plant nutrient and may be automatically adjusted within a short time.

The same trend extending over several years, however, must obviously affect the balance of the reserves of plant food in the soil, and may reduce the ability of that soil to withstand an enforced reduction in supplies in a time of emergency.

Maintenance of Soil Productivity. Renewed interest has been aroused in this question in recent months, for the desirability of keeping as much land as possible in a high state of fertility has been put forward as an important addition to any defence measures. When the agricultural industry is enjoying reasonable prosperity the main objective of the "good" farmer is the maintenance of the cropping

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capacity of his land. This may be partly a matter of personal pride, but it has also the practical advantage that such stored-up fertility will often help crops to withstand temporary adverse conditions and will enable the farmer himself to tide over short periods of depression. For some years past the difficulties of the arable farmer have led him to direct attention more to the immediate problem of cutting down costs to meet the lower prices received for crops, rather than the wider problem of maintaining the cropping power of the land.

The maintenance of the productivity of a soil under arable cultivation is a complex problem of which manuring is only part.

Attempts are frequently made to meet a new crisis in the farming industry by departure from some of the more restrictive and expensive traditional practices, and it is worth while considering how far such alterations may affect the general productivity of the land when continued as a long-term policy. Experimental evidence on these matters is badly needed, for though the Rothamsted and Woburn experiments provide data on some aspects of the problem, the evidence on many points is by no means conclusive. Indeed, the latest account of the Woburn experiments* serves to emphasize both the complexity of the problem and the need for further investigation of many of the points involved.

The Woburn experiments showed that, given suitable manuring, cereal crops can be grown for many years in succession provided pests, diseases and weeds are controlled. Sooner or later, however, yields begin to fall even though no pest or disease has appeared. This deterioration cannot always be arrested even by the application of the requisite amounts of the common plant nutrients, either in the form of artificial fertilizers or as farmyard manure. At Woburn, annual dressings of farmyard manure kept up the yields better than any other method of fertilizing, and though, for wheat, a complete dressing of artificials was almost as good as farmyard manure, it was less effective for barley.

The Woburn results provide no satisfactory answer as to why a crop supplied with dung or with complete fertilizer should show this falling off in yield; but they are not alone in this respect, for the long-term experiments at Rothamsted, on an entirely different soil type, show a similar deterioration.

*" Fifty Years of Field Experiments at the Woburn Experimental Station ": Sir E. J. Russell and J. A. Voelcker.

NOTES ON MANURING

That the yield reductions are not entirely due to some factor associated with the continuous growth of one crop is shown by the fact that similar effects may be seen on the rotation plots at Woburn and Rothamsted. At Woburn the rotation roots—barley—seeds—wheat, receiving only small and irregular supplies of organic matter, failed to maintain yields at their original level.

Again, plots at Woburn on which a mustard or tares crop was ploughed in annually, deteriorated as rapidly as unmanured plots.

The deterioration was completely overcome *for a time* by bare fallowing, but, though the first crop after the bare fallow was as good as the crop before the onset of deterioration, subsequent crops fell off very rapidly and in a short time yields were back at the previous low levels.

To summarize the position, departure in certain directions from the established practices of good husbandry may result in a gradual deterioration in crop yield, the cause of which is not clear. Continuous growth of one crop, year after year, may result in a deterioration that can only be checked by larger dressings of farmyard manure than would normally be available in general farm practice. The deterioration is likely to occur even when complete artificial manures are given, but is more pronounced with incomplete manuring. Ploughing-in mustard or tares does not prevent the deterioration. The yield reductions are temporarily cured by bare fallowing, but the effect of the fallow is quickly exhausted and yields are soon back at their old levels. A similar deterioration has been observed where a rotation of crops is grown in conjunction with unusually small dressings of farmyard manure.

It is well to remember that the trouble apparently becomes really noticeable only after the lapse of several years, for there was little deterioration on plots receiving complete artificial fertilizers during the first 15 years of the Woburn experiments. Deterioration seems to be associated in some way with exhaustion of the organic matter in the soil, and it is suggested that possibly the straw in farmyard manure is the source of some unknown factor not supplied either by artificials or green manuring, and the importance of the humus-forming properties of straw are emphasized. Whatever the explanation of the problem, the moral would seem to be that though ample supplies of farmyard manure will

NOTES ON MANURING

cover a multitude of sins against the old established practices of good husbandry, in the absence of dung the maintenance of the productivity of the soil is a much more difficult problem. It is of course possible to cite farms that appear to have cropped normally for many years without farmyard manure, but no satisfactory explanation has yet been forthcoming for the success of some and failure of others.

A combination of the various factors, such as crop rotation, fallowing, reasonable manuring, etc., will keep the land in good condition, as, of course, happens in ordinary good farming. The problem is, however, both interesting and important in view of the development of new systems of farming and on account of the diminishing supplies of dung. In the long run the fertility of the soil is a reflection of the farming system, which, if not itself sound, cannot be made permanently successful by any system of manuring.

PRICES OF ARTIFICIAL MANURES

Description.	Average prices per ton (2,240 lb.) during week ended April 7.				
	Bristol	Hull	L'pool	London	Costs per Unit¶
Nitrate of Soda (N. 15½%) ..	£ s. 7 12c	£ s. 7 12c	£ s. 7 12c	£ s. 7 12c	s. d. 9 10
" " Granulated (N. 16%) ..	7 12c	7 12c	7 12c	7 12c	9 6
Nitrate of Lime (N. 13%) ..	7 0c	7 0c	7 0c	7 0c	10 9
Nitro-Chalk (N. 15½%) ..	7 5c	7 5c	7 5c	7 5c	9 4
Sulphate of Ammonia:—					
Neutral (N. 20·6%) ..	7 5c	7 5c	7 5c	7 5c	7 0
Calcium Cyanamide (N. 20·6%)	7 5d	7 5d	7 5d	7 5d	7 0
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 0	4 17	4 15	4 17	3 3
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%)	8 3	8 1	7 17	8 1	3 3
Sulphate " (Pot. 48%)	9 15	9 13	9 9	9 13	4 0
Basic Slag (P.A. 15½%) ..	2 12b	2 5b	..	2 10b	3 2
" " (P.A. 14%) ..	2 8b	2 0b	2 0b	2 6b	3 3
Grd. Rock Phosphate (P.A. 26-27½%) ..	2 12a	..	2 10a	2 5a	1 8
Superphosphate (S.P.A. 16%) ..	3 4	..	3 3c	3 0f	3 9
" " (S.P.A. 13½%) ..	3 1	2 17	2 19e	2 16f	4 1
Bone Meal (N. 3½%, P.A. 20½%)	..	6 10	7 5g	7 0	..
Steamed Bone Flour (N. 4%, P.A. 27½%-29½%) ..	5 5½	5 10	5 0g	5 0	..

Abbreviations : N.=Nitrogen ;
S.P.A.=Soluble Phosphoric Acid ;

P.A.=Phosphoric Acid ;
Pot.=Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 4-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 4 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra, for lots of 10 cwt. and under 1 ton, 15s. extra, and for lots of less than 10 cwt. but not less than 2 cwt., 20s. extra.

e Prices shown are f.o.r. Widnes.

f Prices shown are f.o.r. northern rails; southern rails 1s. 3d. extra.

g Prices shown are f.o.r. Appley Bridge.

h Prices shown 1s f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent. nitrogen contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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The Food Requirements of Sheep. The accurate rationing of livestock is only possible under conditions of indoor management or confinement to yards. Under any outdoor system, whether on arable or pasture, there is bound to be great uncertainty as to the amount and food value of the material taken by the animal off the ground, and moreover the variable conditions of exposure from day to day probably give rise to greater variations in the daily food consumption than is customary indoors, even with ad lib. feeding. It is not surprising, therefore, that the formulation of feeding standards for the use in the rationing of sheep has been much more difficult than for dairy cows and pigs, and that at best such standards as have been drawn up for the sheep cannot claim to be more than rough guides to the needs of any particular flock, serving as a starting point for the rationing, to be raised or lowered according to experience, system of management, and nature of food supply.

The first systematic attempt in this country to arrive at the fundamental requirements of the sheep over the whole range of live-weights was made by the late Professor T. B. Wood, in 1928, and his conclusions were embodied in the table of feeding standards contained in the Ministry's Bulletin No. 48. In this table the requirements are given for different live-weights in terms of total dry matter consumed, and the amount of "protein equivalent" that should be contained therein. For a sheep of 100 lb. live-weight for example, the food requirement is given as 24 lb. dry matter per week (or 3·4 lb. per day) including 1½ lb. of "protein equivalent".

The problem has been further explored at Oxford by Scott Watson and his co-workers, who have adduced evidence from the older literature and from new experiments, pointing to the conclusion that Wood's dry matter standards are too high, even for well-balanced rations consisting mainly or entirely

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of palatable dry foods. The highest consumption recorded in Watson's experiments with a wide variety of dry foods fell short of Wood's figures by 10-15 per cent., whilst on a diet of roots, hay and limited concentrates the discrepancy increased to nearly 30 per cent. From his results Watson concluded, therefore, that with the ordinary type of winter feeding practised in this country the daily dry matter consumption of sheep is unlikely to exceed 2.6-2.7 lb. per 100 lb. live-weight, and that this level can only be maintained if from one-third to one-half of the dry matter is given as air-dry foods (hay, meals, etc.). This level of appetite represents 75-80 per cent. of Wood's standard. With heavy root feeding or on low protein rations the consumption of dry matter may be still lower.

This discrepancy between the Cambridge and Oxford standards has led to further investigation at Cambridge, the results of which, as reported by Dr. Woodman and co-workers in two papers in the current issue of the *Journal of Agricultural Science* (Vol. 27, p. 191-211, 212-223), seem to settle the issue in favour of a close approximation to the Oxford standard.

These new Cambridge reports contain much of interest, both as regards the methods of experiment and the details of the data obtained from day to day and at different seasons with individual sheep. The first report deals with trials made in the winters of 1933-34, 1934-35, and 1935-36 with a variety of rations, and the second report with determinations made in the summers of 1934 and 1935 of the amounts of grass consumed by sheep on pasturage of varying quality.

In the first series of trials the sheep were kept continuously out of doors in boarded runs provided with shelters. Suffolk wethers were used in the first winter, and cross-bred wethers by Suffolk ram out of Cheviot x Border Leicester ewes in the two following winters. Ten experimental feeding periods of 14 days each were carried out in the first winter, and nine in each of the following years.

In the first year, the trials commenced in October and the diets tested consisted of lucerne hay of medium quality fed both in the chaffed and in the long condition; unchaffed lucerne hay of very good quality; lucerne hay and swedes; lucerne hay, swedes and balanced concentrates; ryegrass-sainfoin hay, swedes, and concentrates; hay, marrow-stem kale and concentrates; hay, raw potatoes and concentrates.

In the second year, the trials commenced early in July and

NOTES ON FEEDING

the diet in the first period consisted of meadow hay, green lucerne and concentrates. Subsequently, the lucerne was replaced by either marrow-stem kale or thousand-head kale.

In the third year, the trials commenced in early September, and the rations up to the last period consisted of hay, marrow-stem kale and concentrates. In the final period the kale was replaced by sliced mangolds.

The rations thus included a considerable variety of foods, but in most periods were of the hay-succulents-concentrates type.

On every diet the variations of consumption from day to day were considerable for each individual sheep. In one specimen case quoted, in which the animal was on a diet of chaffed meadow hay ad lib, marrow-stem kale ad lib, and a fixed allowance of concentrates, the variations in daily consumption of dry matter on 14 consecutive days ranged from 184 to 549 grm. for the hay, from 646 to 954 grm. for the kale, and from 1155 to 1654 grm. for the total dry matter consumed. On each diet a similarly wide range of variation was also observed in consumption as between different individuals.

On comparing the results obtained on different diets, it is noted that, on changing from a diet of chaffed lucerne hay to one of the same hay fed long, the average daily consumption was lowered by nearly $\frac{1}{2}$ lb. of dry matter per head. With lucerne hay of better quality, even though fed in the long state, the daily consumption rose fully up to the original level.

In most instances the feeding of swedes along with the lucerne hay caused a slight depression of appetite, amounting on the average to about 5 per cent., but this was fully rectified when balanced concentrates were added to the diet. Replacement of swedes by kale did not materially affect the results, but when raw potatoes took the place of swedes the daily intake of dry matter was considerably reduced.

When the results are arranged with relation to the live-weights of the sheep in each period, it is seen that at all weights the average daily consumption of dry matter was well below the amounts expected from Wood's standards, the extreme individual values ranging from 69 to 108 per cent. of the expected appetites. In 34 out of 159 animals the consumption lay between 69 and 80 per cent. of the predicted value, in 86 animals between 80 and 90 per cent., in 27 animals between 90 and 100 per cent., and in 12 animals between 100 and 108 per cent. The general average of all

NOTES ON FEEDING

results was 86.0 per cent. On the whole the degree of deficiency below Wood's standards was much the same throughout the whole live-weight range, with a slight tendency towards better appetites relative to the standards at the highest weights from about 135 lb. onwards. If the results for these heavier sheep be excluded, the average of the remaining 136 results for sheep varying from 60 to 135 lb. live-weight works out at 85.2 per cent., and Woodman suggests, therefore, that the dry matter standards in Wood's table be corrected by multiplication by the factor 0.85, or a reduction of 15 per cent. This gives, for example, for the 100 lb. sheep a daily appetite standard of 2.9 lb. (3.4×0.85), a figure in reasonably good agreement with Watson's figure of 2.6-2.7 lb., Kellner's figure of 2.6 lb. and Henry and Morrison's 2.7-3.1 lb.

The new standards for dry matter arrived at as indicated above are summarized below :—

<i>Live Weight</i>		<i>Appetite</i>	
		<i>Dry Matter per Week</i>	
<i>lb.</i>			<i>lb.</i>
60	..	.	14.5
80	17.9
100	20.4
120	.	..	22.9
140	25.5
160	..	.	28.0
180	.	..	29.8
200	31.5

In the same paper, the Cambridge authors re-examine the evidence as to the maintenance requirements of sheep at different live-weights, as to which previous work at Cambridge had led to the conclusion that the standards of Kellner and others were much too low. This conclusion is confirmed by the additional data now available, and therefore no change is necessary in this particular in the revision of Wood's standards.

Grass Consumption by Sheep. The difficulties involved in ascertaining the amount of grass consumed by sheep under pasturage conditions, to which reference was made in the opening paragraph, were apparently overcome with a considerable measure of success by the Cambridge workers by the ingenious but laborious device of running digestion trials with weighed amounts of grass in parallel with the grazing trials, and comparing the weights of dry matter voided as faeces in the two series.

NOTES ON FEEDING

In the first grazing period of the season 1934 (May 10-24), conditions were ideal for high consumption, the herbage available being excellent in quality and digestibility. Under these conditions, and in marked contrast to the winter feeding results summarized above, the sheep consumed amounts of dry matter that were from 4 to 17 per cent. in excess of Wood's standards (unrevised). This increase in appetite is ascribed to the high palatability of the young spring herbage, and confirms the view that farm animals in general tend to over-eat when first put out to grass in spring, frequently with resultant "scouring", which is not surprising in view of the succulent, protein-rich nature of the herbage.

During the second grazing period of 1934 (June 5-16), the quality of the herbage was not so good, the digestibility of the organic matter being about 10 per cent. less than in the first period, and probably also there had been a corresponding decline in palatability. Despite these disadvantages, the consumption of dry matter was little short of Wood's standards, the averages for different sheep ranging from 94 to 106 per cent. of the "standard" values in the first half of the period, and from 90 to 100 per cent. in the second half, when the grass had undergone further deterioration in digestibility and quality. Thus even at the worst the grazing animals were taking appreciably more dry matter per day than they did on the winter diets.

In the 1935 trials, which commenced in May, the condition of the grass at the outset was by no means so good as in May of the previous year, and consequently the dry matter consumption did not reach the same level, although still well up to Wood's standards (98-108 per cent.).

From these results we may infer that sheep consume a bigger ration, in terms of dry matter, when on pasture in spring and summer than under winter feeding conditions with diets composed of hay, succulents and concentrates. The size of the ration will vary according to the quality of the herbage, and will normally be greatest on young, leafy pasturage.

Influence of Food Oil on Body Fat in the Fowl. An important factor in the problem of securing high quality meat production is the tendency of any oils in the food to impart their character to the fats of the body. Food oils of a softening tendency will lead to a softening of the body fat,

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and this means that fats that are naturally inclined to be soft, such as the fat of the pig and the fowl, may thereby be seriously deteriorated in dietetic value.

This problem, in its application to the fowl, has for some years occupied the attention of the Poultry Section of the Cambridge Animal Nutrition Research Institute, whose reports have indicated a close relationship in this instance between food-oil and body-fat. In particular it is the unsaturated acids of the food oils that tend to accumulate in the body-fat. A measure of these unsaturated acids is given by the power of the oil for combining with iodine, so that, broadly speaking, an oil of low "iodine value" may be described as "hardening" and one of high iodine value as "softening" in its effect upon the body fat.

In poultry fattening, the foods used chiefly are oats, maize and barley, the first two being comparatively rich in oil of softening character (3-6 per cent.), and it is therefore obviously of interest to know how these cereals compare in their influence upon the consistency and quality of the body fat deposited during the fattening period.

Data upon this subject are given in a paper by Dr. Cruickshank of the Cambridge Institute, in the current issue of the *Journal of Agricultural Science*. In her experiments the three cereals mentioned above were compared both with young and with older birds (Light Sussex), the ration in all instances consisting of 88 parts of the ground cereal mixed with 12 parts of dried skim milk.

In both experiments the best growth rates were obtained on the oats ration, with barley second, and maize a bad third.

With the mature birds the general consistency of the fats was practically normal, but the softest fat, as judged by the iodine value and other criteria, was produced by the oats ration, followed closely by the maize ration. From this it must not be assumed, however, that the oil of barley is a less potent softener than the oils of maize and oats, since, owing to the poverty of barley grain in oil, less of this oil was fed than of the other two oils.

In the second experiment, in which the birds were less mature, and consequently the live-weight increases were greater, the body fat in all three groups was very similar, and gave an iodine value rather lower than the normal, or in other words tended to be firm rather than soft. In explanation of this result it is suggested that, since the weight

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increases during the period were greater (i.e., the fattening was more rapid), a greater proportion of the fat had to be formed from the carbohydrate fraction of the food, which gives hard fat. This is in accordance with the experience in pig-breeding that rapid fattening tends to the production of firmer fat than slow fattening.

These Cambridge results thus offer no support to the objections often raised against the use of maize in poultry fattening on the grounds of its assumed softening influence. That it exerts such an influence in pig-fattening can hardly be doubted, but with pigs the fattening period is far more prolonged than with poultry, and the proportion of body-fat produced from the oil of the maize correspondingly greater.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	10 0	0 8	9 12	72	2 8	1.43	9.6
Barley, British Feeding	8 10	0 8	8 2	71	2 3	1.20	6.2
„ Argentine	8 17	0 8	8 9	71	2 5	1.29	6.2
„ Persian	8 7*	0 8	7 19	71	2 3	1.20	6.2
„ Polish	8 12§	0 8	8 4	71	2 4	1.25	6.2
Oats, English, white ..	8 13	0 9	8 4	60	2 9	1.47	7.6
„ „ black and grey	8 13	0 9	8 4	60	2 9	1.47	7.6
„ Scotch, white	9 7	0 9	8 18	60	3 0	1.61	7.6
„ Canadian, mixed feed	8 5	0 9	7 16	60	2 7	1.38	7.6
Maize, Argentine	7 0	0 7	6 13	78	1 8	0.89	7.6
„ Gal. Fox	6 13†	0 7	6 6	78	1 7	0.85	7.6
„ South African, No. 3, White Flat	7 2†	0 7	6 15	78	1 9	0.94	7.6
Beans, English, Winter ..	7 0§	0 17	6 3	66	1 10	0.98	19.7
Peas, English Blue	11 5§	0 15	10 10	69	3 1	1.65	18.1
„ Japanese	24 5†	0 15	23 10	69	6 10	3.66	18.1
Dari	8 5†	0 8	7 17	74	2 1	1.12	7.2
Milling Offals:—							
Bran, British	7 12	0 16	6 16	43	3 2	1.70	9.9
„ broad	8 2	0 16	7 6	43	3 5	1.83	10
Weatings†	7 17	0 14	7 3	56	2 7	1.38	10.7
„ Superfine†	8 7	0 13	7 14	69	2 3	1.20	12.1
Pollards, imported ..	7 2	0 14	6 8	50	2 7	1.38	11
Meal, barley	10 0	0 8	9 12	71	2 8	1.43	6.2
„ „ grade II	9 5	0 8	8 17	71	2 6	1.34	6.2
„ maize	7 7	0 7	7 0	78	1 10	0.98	7.6
„ „ germ	7 10	0 11	6 19	84	1 8	0.89	10.3
„ locust bean	7 15	0 5	7 10	71	2 1	1.12	3.6
„ bean	8 10	0 17	7 13	66	2 4	1.25	10.7
„ fish (white)	14 15	2 2	12 13	59	4 3	2.28	53
„ Soya Bean (Ex- tracted) †	8 10	1 9	7 1	64	2 2	1.16	38.3
Maize, cooked, flaked ..	7 17	0 7	7 10	84	1 9	0.94	9.2
„ gluten feed	7 12	0 13	6 19	76	1 10	0.98	19.2
Linseed cake—							
English, 12% oil ..	10 2	1 0	9 2	74	2 6	1.34	24.6
„ 9% „	9 10	1 0	8 10	74	2 4	1.25	24.6
„ 8% „	9 5	1 0	8 5	74	2 3	1.20	24.6
Cottonseed cake, English, Egyptian seed, 4½% oil	5 17	0 18	4 19	42	2 4	1.25	17.3
Cottonseed cake, Egyptian, 4½% oil ..	5 5	0 18	4 7	42	2 1	1.12	17.3
Cottonseed cake, decorticated, 7% oil...	8 15†	1 8	7 7	68	2 2	1.16	34.7
Cottonseed meal, decorticated, 7% oil ..	8 15†	1 8	7 7	70	2 1	1.12	36.8

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
Coconut cake, 6% oil ..	£ s. 7 5	£ s. 0 18	£ s. 6 7	77	s. d. 1 8	d. 0·89	% 16·4
Ground nut cake, decorticated, 6-7% oil	8 2†	1 8	6 14	73	1 10	0·98	41·3
Ground nut cake, imported decorticated, 6-7% oil	8 5	1 8	6 17	73	1 11	1·03	41·3
Palm-kernel meal, 1-2% oil	7 0	0 12	6 8	71	1 10	0·98	16·5
Feeding treacle	5 0	0 8	4 12	51	1 10	0·98	2·7
Brewers' grains, dried alc	6 7	0 11	5 16	48	2 5	1·29	12·5
" " " porter	6 0	0 11	5 9	48	2 3	1·20	12·5
Dried sugar-beet pulp ..	From £5 7s. 6d. to £5 17s. 6d. per ton ex-factory (according to factory).						

* At Bristol. § At Hull. † At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE: The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of March, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 per ton as shown above, the cost of food value per ton is £10. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1·43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 3d.; P₂O₅, 2s. 3d.; K₂O, 3s. 6d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6·2	8 12
Maize	78	7·6	7 0
Decorticated ground-nut cake ..	73	41·3	8 3
„ cotton-seed cake ..	68	34·7	8 15

(Add 10s. per ton, in each instance, for carriage.)

The cost per unit starch equivalent works out at 2·16 shillings, and per unit protein equivalent 0·70 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The Table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent	Protein equivalent	Food Value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	8 2
Oats	60	7·6	6 15
Barley	71	6·2	7 18
Potatoes	18	0·8	1 19
Swedes	7	0·7	0 16
Mangolds	7	0·4	0 15
Beans	66	19·7	7 16
Good meadow hay	37	4·6	4 3
Good oat straw	20	0·9	2 4
Good clover hay	38	7·0	4 7
Vetch and oat silage ..	13	1·6	1 9
Barley straw	23	0·7	2 10
Wheat straw	13	0·1	1 8
Bean straw	23	1·7	2 11

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d., post free 7d.

MISCELLANEOUS NOTES

The Agricultural Index Number

THE March index of the prices of agricultural produce at 130 (base 1911-13=100) is 1 point higher than in February and 14 points above the figure recorded for March, 1936. (If allowance be made for payments under the Wheat Act, 1932, and the Cattle Industry (Emergency Provisions) Act, 1934, the revised index becomes 134.) During the month under review, average prices of fat cattle and sheep, butter, cheese, poultry, potatoes and hay moved upwards, whereas those of wheat, barley, oats, fat pigs and eggs declined.

Monthly index numbers of prices of Agricultural Produce (Corresponding months of 1911-13 = 100.)

Month	1932	1933	1934	1935	1936	1937
January .. .	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	..
May	115	102	112	111	115	..
June	111	100	110	111	116	..
July	106	101	114	114	117	..
August	105	105	119	113	119	..
September	104	107	119	120	127	..
October	100	107	114	113	125	..
November	101	109	114	113	125	..
December . . .	103	110	113	114	126	..

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and the Cattle Industry (Emergency Provisions) Act (b).

Month	1932	1933	1934	1935	1936	1937
January .. ..	..	111	119	124	125	133
February .. ..	..	110	117	122	123	133
March .. ..	..	106	112	118	122	134
April .. ..	..	109	116	126	128	..
May .. ..	..	105	116	117	120	..
June .. ..	..	104	114	117	121	..
July .. ..	..	104	117	120	121	..
August	108	108	122	120	124	..
September	108	111	125	128	133	..
October	104	112	121	119	129	..
November	105	113	120	119	129	..
December	107	114	120	120	130	..

(a) Commenced August, 1932

(b) Commenced September, 1934.

MISCELLANEOUS NOTES

Grain. The monthly average price of wheat at 9s. per cwt. was 1d. below that of February and the index declines from 122 to 121. (If the deficiency payment under the Wheat Act, 1932, is taken into account, the index is 133.) Barley at 9s. 10d. and oats at 8s. 2d. per cwt. showed a reduction on the month of 2d. and 1d. per cwt. respectively; the index for the former at 124 remains unchanged, owing to a similar downward movement in the base price, but the index for oats falls by 1 point to 115. In March, 1936, wheat averaged 6s. 3d., barley 7s. 7d. and oats 5s. 11d. per cwt., the relative indices being 84, 96, and 84.

Livestock. Quotations for fat cattle, which had been rising since November last, showed a further advance, the average for second quality moving from 34s. 3d. in February to 36s. per live cwt., and the index at 102 for March is higher by 3 points. The addition of the subsidy under the Cattle Industry (Emergency Provisions) Act, 1934, brings the index up to 117. At 1s. per lb. for second quality, the average price of fat sheep appreciated by 1d. and the index moves upwards from 137 to 145 points. Baconers at 12s. 3d. and porkers at 13s. 1d. per score (20 lb.) were lower by 1d. and 2d. respectively than in February; the relative indices decline by 4 points to 122 and 1 point to 124.

Dairy cows were cheaper by 13s. per head, but owing to a fall of a somewhat similar amount in the base price, the index remains unaltered at 111. Quotations for store cattle and sheep were higher than in February, the index for the former appreciating from 101 points to 105, and that for the latter from 115 points to 117. Store pigs were slightly reduced in price; the index at 129 shows a fall of 10 points by reason of the reverse price movement which took place during the corresponding months of 1911-13.

Dairy and Poultry Produce. The regional contract price of liquid milk remained at last month's level and the index of 171 is repeated. Butter rose by $\frac{1}{4}$ d. to 1s. 2 $\frac{1}{4}$ d. per lb., the index at 100 being higher than in February by 3 points. Eggs averaged 10s. 2d. per 120, compared with 13s. 1d. in February, but as the reduction was less than that recorded during the base years, the index rises from 115 to 121. At £4 2s. 6d. per cwt., cheese realized 2s. 6d. per cwt. more than a month earlier, while at 110 the index is increased by 3 points. All descriptions of poultry were dearer and the combined index moves upwards from 121 to 123.

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Other Commodities. Prices of potatoes advanced to a small extent, and the average rose by 2s. to £7 17s. per ton; owing, however, to a proportionately higher rise having occurred in the base prices, the index is reduced by 1 point to 200. Both clover and meadow hay were a little firmer in price, the combined index now standing at 101 as against 98 a month ago. At 1s. 4½d. per lb. wool was unchanged, but a slight rise during the base period causes the index to fall from 131 to 130.

Monthly index numbers of prices of individual commodities. (Corresponding months of 1911-13 = 100.)

Commodity	1935	1936		1937		
	Mar.	Mar.	Dec.	Jan.	Feb.	Mar.
Wheat	62	84	118	133	122	121
Barley	95	96	115	125	124	124
Oats	96	84	101	120	116	115
Fat cattle	88	93	91	97	99	102
„ sheep	139	115	128	140	137	145
Bacon pigs	114	112	124	130	126	122
Pork	120	117	131	131	125	124
Eggs	94	109	106	95	115	121
Poultry	124	120	119	120	121	123
Milk	161	171	171	171	171	171
Butter	88	95	98	95	97	100
Cheese	91	97	103	107	107	110
Potatoes	108	193	220	205	201	200
Hay	103	81	98	98	98	101
Wool	83	96	118	131	131	130
Dairy cows	101	102	111	111	111	111
Store cattle	86	92	98	99	101	105
„ sheep	113	102	113	118	115	117
„ pigs	130	123	156	152	139	129

Revised index numbers due to payments under the Wheat Act and the Cattle Industry (Emergency Provisions) Act.

Wheat	117	122*	134	134	133	133
Fat cattle	102	107	105	112	114	117
General Index	118	122	130	133	133	134

* Superseding figure previously published.

Importation of Cherries

With the object of preventing the introduction of the Cherry Fruit Fly, the Minister of Agriculture and Fisheries has made an Order under the Destructive Insects and Pests Acts, 1877

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to 1927, regulating the importation of cherries into England and Wales during the 1937 season.

Cherries grown in *Spain* will be admitted without restriction until May 18, after which date the importation of Spanish cherries is prohibited.

Cherries grown in *France* will be admitted until May 27 if accompanied by a certificate of origin; after that date the importation of French cherries is prohibited with the exception of those certified to have been grown within a small district around Honfleur; details of this district are given in the Order.

Cherries grown in *Italy* will be admitted until June 12 if accompanied by a certificate of origin; after that date only those certified to have been grown within the Region of Emilia or the Province of Verona will be allowed to enter; after June 23 the importation of all Italian cherries is prohibited.

Cherries grown in *Germany* will be admitted until June 26 if accompanied by a certificate of origin; after that date no German cherries will be admitted except those certified not to have been grown south of latitude 53° N. or in East Prussia.

Cherries grown in *Hungary* will be admitted until June 17 if accompanied by a certificate of origin; after that date the importation of Hungarian cherries is prohibited.

Certificates of origin must accompany cherries grown in any other European country, when imported after May 18.

Copies of the Importation of Raw Cherries Order of 1937 (S. R. and O. 1937, No. 292) may be obtained from H.M. Stationery Office, price 2d. net.

Agricultural Research Scholarships and Studentships for Research in Animal Health

ACTING in consultation with the Agricultural Research Council, the Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland invite applications for the following *post-graduate* Agricultural Research Scholarships and Studentships for Research in Animal Health, tenable as from October 1, 1937, for a period not exceeding three years:—

- (i) Not more than four Agricultural Research Scholarships, each of the value of £200 per annum, to which will be added, if necessary, a sum which will not normally exceed £50 per annum for fees and expenses.
- (ii) Not more than three Studentships for Research in Animal Health, each of an *inclusive* value not exceeding £300 per annum. A Veterinary Scholarship of the value of £200 per annum, with

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allowances not exceeding £50 per annum, and tenable for not more than four years, may be awarded instead of one of these Research Studentships to enable a graduate with Honours in Science to obtain a veterinary professional qualification with a view to undertaking research in animal health.

Applications must be received not later than May 31, 1937. Nomination forms and further particulars may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, S.W.1, or from the Secretary, Department of Agriculture for Scotland, 29 St. Andrew Square, Edinburgh 2, according to the country in which the candidate resides.

Travelling Scholarship in Agriculture

THE Governors of the College of Estate Management offer a Travelling Scholarship to the value of £300, tenable for one year, for the purpose of studying agricultural methods in this country and abroad.

The Scholarship is open to British-born graduates of a British University, or those holding such qualifications as may be approved by the Board of Governors of the College.

All applicants must be under thirty years of age on the date of application.

The next award of the Scholarship will be made at the end of the year 1937, and application forms will then be obtainable from the Secretary of the College, 35 Lincoln's Inn Fields, W.C.2.

Coronation Day Bonfires

A chain of large bonfires on high points throughout the country is being organized as part of Coronation Day celebrations. Local Authorities and others proposing to erect a bonfire are requested to take the utmost care to ensure the avoidance of disturbance or damage to any Ordnance Survey triangulation pillar which may be in the vicinity.

Large numbers of these concrete pillars have been erected by the Ordnance Survey on hills and mountains throughout the country to mark positions that have been established in connexion with the retriangulation of Great Britain. If a pillar, or its foundations, were disturbed or cracked by the heat of a bonfire or by onlookers, the accuracy of the triangulation position would be lost, and considerable delay and expense would be entailed in making the re-observations necessary to establish it again.

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For this reason, no bonfire should be erected within 50 yards of any such pillar, and adequate steps should also be taken to prevent any damage to pillars by onlookers.

Tithe Redemption Annuities

The Tithe Redemption Commission draw the attention of owners of land which was subject to tithe rentcharge to the fact that, by the Tithe Act, 1936, tithe rentcharges (including Extraordinary tithe rentcharges) were extinguished on October 2, 1936, and in place of each tithe rentcharge a redemption annuity, payable to the Commission, is charged for a period of 60 years from that date. The annuities are payable half-yearly on April 1 and October 1. The demands for the first half-yearly instalments, which became due on April 1, 1937, will be issued shortly by the collectors for the Commission, who are not in all instances the former collectors of tithe rentcharge.

Enforcement of Minimum Rates of Wages. During the month ending April 15, 1937, legal proceedings were taken against nineteen employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow :—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers involved
Buckinghamshire ..	Great Missenden	£ s. d. 0 10 0	£ s. d. 2 12 0	£ s. d. 39 15 11	2
Cambridgeshire ..	March ..	40 0 0	1 0 0	53 14 10	2
Cornwall ..	Liskeard ..	10 0 0	—	2 12 7	2
Dorsetshire	Dorchester	10 0 0	0 8 6	20 0 0	1
Durham	West Hartlepool	1 10 0	—	20 5 2	3
Essex ..	Romford	4 0 0	—	24 16 0	1
Gloucestershire ..	Chipping Campden	2 0 0	0 9 6	21 1 8	1
Herefordshire	Ledbury ..	15 0 0	—	18 10 0	1
Lincs (Kesteven and Lindsey) ..	Grantham	3 0 0	2 2 0	20 0 0	3
Yorks (East Riding) ..	Market Weighton	1 0 0	0 6 0	9 12 9	1
Breconshire	Builth Wells	4 0 0	1 16 0	25 0 0	2
		91 0 0	8 14 0	255 8 11	19

WIRELESS TALKS TO FARMERS, MAY, 1937

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speakers</i>	<i>Subject</i>
National :			
May 3	6.20	Mr. J. G. Stewart	Beef.
" 17	6.20	" "	Cornish Farming.
" 24	6.20	" "	Dairy Cows.
" 31	6.20	Mr. J. G. Stewart and an Australian Farmer	Sheep Shearing.
West :			
May 6	2.30	Rt. Hon. W. S. Morrison, M.P., Minister of Agriculture	Cider Tasting at Long Ashton : Presentation of prizes and address.
" 20	6.40	—	For Western Farmers.
North :			
May 7	7.30	Messrs. J. A. Hanley, N. McVicar and W. B. Mercer	For Northern Farmers : Farming Fundamentals.
" 20	—	—	" Sheep Fratch " (i.e. a discussion about sheep), by three Keswick Flockmasters and Mr. R. H. Lamb, of Caldbeck, a farmer-journalist, who resides in the farm adjoining that in which John Peel lived, on the eve of Keswick May Fair, with particular reference to the blackfaced variety of sheep.
Welsh :			
May 5	5. 0	Mr. A. W. Ling	Children's Hour : Down on the Farm.
" 6	5. 0	Mr. T. H. Evans, who will bring an expert to the studio	Children's Hour : Sheep Dog Trials.
" 7	8.40	Messrs. W. H. Jones and H. James	For Welsh Farmers : "Rural Electrification and its Development.
" 21		—	For Welsh Farmers (from Aberystwyth).
Scottish :			
May 6	6.50	Mr. A. D. Buchanan Smith	For Scottish Farmers.
" 19	6.15	Mr. J. Ritchie	Maggot Fly on Sheep.
" 25	6.20	Mr. R. L. Scarlett	For Scottish Farmers.
Northern Ireland :			
" 7	8.30	S. Shaw, Jean Fullerton, Marian Dickson and F. Patterson	Young Farmers' Clubs : A Discussion — That the Ulster Farmer of To-day is Not Progressive.

NOTICES OF BOOKS

Foot-and-Mouth Disease.—No outbreak of Foot-and-Mouth Disease has been confirmed since February 5. At the time this issue of the JOURNAL went to press, no part of Great Britain was subject to any restriction in connexion with this disease.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Bucks : Miss M. McKenzie has been appointed Instructress in Rural Domestic Economy.

Cornwall : Mr. R. Gardner, N.D.H., has been appointed Lecturer in Horticulture for West Cornwall.

Norfolk : Mr. R. Line, B.Sc.(Agric.), N.D.A., has been appointed Senior Agricultural Advisory Officer for West Norfolk, *vice* Mr. D. H. Findlay, B.Sc.(Agric.), N.D.A., N.D.D

NOTICES OF BOOKS

The Second Report on the Corrosion of the Tinplate Container by Food Products. Department of Scientific and Industrial Research : Food Investigation, Special Report No. 44. By T. N. Morris, M.A., and J. M. Bryan, B.Sc., Ph.D. Pp. vi + 54. (London : His Majesty's Stationery Office. 1936. Price 1s)

This publication reviews the work that has been done on the subject since 1931, when the first reprint appeared. It consists chiefly of descriptions of a large number of experiments. The details given are mainly of interest to research workers, but for the benefit of canners and practical technicians, points of practical significance are brought out with brevity and clarity. The summary of the report is necessarily brief, since we are as yet only on the threshold of a successful attack on the problem of tinplate corrosion. The lines of the next advances, however, are now clear. The general introduction should be read by everyone in the canning industry, since the position is there stated with admirable clarity and succinctness.

Up from Poverty in Rural India. By D. Spencer Hatch, B.Sc., M.Sc. in Agr., Ph.D. Preface by the Earl of Willingdon. 3rd edition. Pp. xix + 208, and 12 Figs. (Oxford University Press, 1936. Price 4s. 6d.)

Most of the readers of this JOURNAL are interested in the affairs of India, while some have a practical interest in the rural problem that has long been one of the chief preoccupations of the administrations in that important part of the Empire. To either of these groups this survey should make a strong appeal, especially at a time when India looms so large in the public mind. In spite of the progress that has been achieved under the British Raj, the problem as stated in the opening chapters is certainly grave. Dr. Hatch writes from a long experience of various efforts to improve rural conditions, the guiding principle of which has been "self-help with intimate expert counsel," and, although progress must necessarily be slow, there can be no doubt that the methods adopted are gradually bringing a fuller and happier life to some of the poorest people in the world.

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- International Institute of Agriculture*.—A Survey of Current Bibliographies on Agriculture and Allied Subjects. (84 pp.) Rome, 1937, 10 *lire*.
- Board of Trade*.—Report on the Import Duties Act Inquiry (1934), Part I. The Textile Trades, The Leather and Clothing Trades, The Food Trades, The Chemical and Allied Trades, Miscellaneous Trades and a General Summary Statement. (xii + 386 pp.) London: H.M. Stationery Office, 1936, 6s.
- British Commonwealth Scientific Conference, London, 1936*.—Report of Proceedings. (74 pp.) (Cmd. 5341.) London: H.M. Stationery Office, 1937, 1s. 3d.
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- Grayson, D.*.—The Countryman's Year. (272 pp.) London: Hodder & Stoughton, 1936, 5s.
- Jones, S. R.*.—English Village Homes. (vii and 120 pp. + 99 plates.) London: B. T. Batsford, 1936, 7s. 6d.
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- Goodwin, M. E., and Morgan, Q. I.*.—Practical Science of Living Things. Book II. (125 pp.) London: Gregg Publishing Co., 1936, 1s. 6d.
- Mountjoy, T. W. H.*.—Points of the Dog. (281 pp. + 48 plates.) London: Eveleigh Nash & Grayson, 1930, 3s. 6d.
- Wilson, H. F.*.—Columbia University Studies in the History of American Agriculture—III. The Hill Country of Northern New England, Its Social and Economic History, 1790–1930. (xv + 455 pp. + 4 plates.) New York: Columbia University Press; London: Humphrey Milford, 1936, 21s.
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- International Institute of Agriculture*.—Studies of the Principal Agricultural Products on the World Market. No. 2. International Trade in Meat (xi + 424 pp.) Rome, 1936, 25 *lire*.

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- Contrast Between the International Trade in Agricultural Machines and in the Technical Progress Made in Their Manufacture. *H. J. Hopfen*. (Int. Rev. Agric. Mon. Bull. Agric. Sci. Prac. 27, 12 (Dec. 1936), pp. 445-453.)

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- The Effects of Alternate Periods of Light and Darkness of Short Duration on the Growth of the Cucumber. *G. B. Portsmouth* (Ann. Bot. 1, 1 (Jan. 1937), pp. 175-189.)

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- World Maize Production and Trade. *V. Desmireanu*. (Int. Rev. Agric. Mon. Crop. Rep. and Agric. Stats. 27, 12 (Dec. 1936), pp. 879-892.)
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- The Construction of Cow Houses. *G. V. Charlton*. (J. Land Agents' Soc. 36, 1 (Jan. 1937), pp. 18-23 + 1 plate.)
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- Seed Disinfection. III. Experiments on the Germination of Peas. Seed Protection by the Use of Disinfectant Dusts containing Mercury. *C. C. Brett*, *W. A. R. Dillon Weston* and *J. R. Booer*. (J. Agric. Sci. 27, 1 (Jan. 1937), pp. 53-66 + 1 plate.)

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- Digestibility Trials with Poultry. VIII. The Digestibility of Dried Molassed Sugar-Beet Pulp. *E. T. Halnan*. (J. Agric. Sci. 27, 1 (Jan. 1937), pp. 137-142.)
- Soybean Oil Meal Prepared at Different Temperatures as a Feed for Poultry. *J. W. Haywood*, *J. G. Halpin* and *Others*. (Poult. Sci. 16, 1 (Jan. 1937), pp. 3-14.)
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- Available Calcium a Factor in Salt Balance for Vegetable Crops. *V. A. Tiedjens* and *L. G. Schermerhorn*. (Soil Sci. 42, 6 (Dec. 1936), pp. 419-433.)
- Soil Warming. *E. Brooks*. (Estate Mag. 37, 1 (Jan. 1937), pp. 24-28.)
- The Character of Barley Grown on Soil Made Acid with Sulphate of Ammonia. *H. H. Mann*. (J. Agric. Sci. 27, 1 (Jan. 1937), pp. 18-122 + 1 plate.)
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NOTES FOR THE MONTH

Milk and Nutrition

IN December, 1934, on the initiative of the Advisory Committee on Milk Publicity of the Milk Marketing Board for England and Wales, a Milk Nutrition Committee was set up under the chairmanship of Lord Astor to undertake investigations into the nutritive value of milk, with particular reference to the effect of pasteurization. The broad lines of the proposed investigations were settled by the Nutrition Committee, which set up an Expert Sub-Committee under the chairmanship of Sir John Orr to plan the details of the investigations and to supervise their carrying out.

The principal research was carried out at certain elementary schools with the object of ascertaining the benefits of the consumption of milk made available in connexion with the arrangements under Section II of the Milk Act, 1934, for increasing the demand for milk by the supply of milk at reduced rates. In addition, experiments on rats and on calves, as well as some purely chemical work, were undertaken by the National Institute for Research in Dairying, Reading, and by the Rowett Institute, Aberdeen. These two Institutes have prepared a report* that deals with the results of the work with rats and that on the direct chemical estimations of vitamin potency. Further reports, dealing with the investigations in schools and with calves, will be published in the near future.

The investigations dealt with in this report were designed to measure the effect of commercial pasteurization on the nutritive value of milk. The report gives full details of the experimental technique and of the data obtained. A statistical

* *Milk and Nutrition: New Experiments Reported to the Milk Nutrition Committee. Part I, The Effect of Commercial Pasteurization on the Nutritive Value of Milk as Determined by Laboratory Experiment.* Pp. 67 + 13 inset tables, and 8 Figs. (to be purchased directly from the National Institute for Research in Dairying, Shinfield, Reading, 1937. Price 2s. 6d. net, by post 3s.).

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appendix shows how, in the analysis of the data, use has been made of recently devised methods applicable to small samples (in most of the experiments 6 pairs of rats were used).

The conclusions drawn from the direct chemical estimations of vitamin potency are that neither vitamin A itself, nor the pro-vitamin, carotene, is affected by commercial pasteurization. Commercial pasteurization, however, was found to cause a loss of about 20 per cent. of the original vitamin C content of the milk but experiments recorded elsewhere have shown that this loss only occurs if the milk has been previously exposed to light.

The conclusions drawn from the experiments on rats are that the nutritional availability of the calcium and phosphorus in milk is unaffected by pasteurization. It also appears that the biological value and digestibility of the protein are not affected by pasteurization. It was found that when used for rats as an exclusive diet, pasteurized milk supplemented with iron, copper and manganese is not inferior to raw milk supplemented in the same way (in both cases the mineral supplements were necessary in order to avoid nutritional anaemia which would otherwise overshadow the point at issue). There was some loss, however, of vitamin B (undifferentiated).

The report does not discuss the extent to which the findings obtained with the rat as the experimental animal are capable of application to the problems of human nutrition, and more particularly the bearing that the results recorded may have on the question of the advisability or otherwise of pasteurization of milk for human consumption. It is intended to deal with these points in due course, but to wait until the findings of the investigations on calves and on schoolchildren become available so as to permit of a wide basis of assessment.

Marsh Spot in Pea Seeds

The following note has been communicated by Dr. G. H. Pethybridge, O.B.E. :—

IN this JOURNAL for December, 1934, and for April, 1936, articles on Marsh Spot in Pea Seeds were published. In the latter, evidence was given that supported the idea that this trouble—the cause of which has for so long remained a mystery—might be due to manganese deficiency in the soil; and, in this connexion, trials recently carried out in Holland are of particular interest. The March number of the Dutch *Tijdschrift over Plantenziekten* has two articles on the

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subject by Mr. A. Ovinge and Mr. C. Koopman respectively. The trials carried out by the former in 1935 and 1936 show clearly that some varieties of peas, e.g., Zelka and Mansholts, are much less susceptible to Marsh Spot than others, like Jumboka. The application of a solution of manganese sulphate to the soil between the rows at the time of flowering resulted in a very definite reduction of the percentage of Marsh Spot in the harvested seeds. Those from the untreated crop showed 26 per cent. of attack, whereas when sulphate of manganese was applied at the rate of 100 kg. per ha. (about $\frac{3}{4}$ cwt. per acre) the figure was 8 per cent., and with double this quantity only 2 per cent. Mr. Koopman's trials are of special interest because he sprayed his plants with a 0.1 per cent. solution of sulphate of manganese, first just after they had finished flowering and a second time about three weeks later. Jumboka and Zelka were the two varieties used and the percentage of Marsh Spot was reduced from 33 to 10 in the former and 11 to 0.5 in the latter. In Jumboka, too, the peas from the sprayed crop were larger than those from the unsprayed. Mr. Koopman considers the results so promising that he recommends growers to carry out spraying trials on a large scale during the present season. The amount to apply, the best times for application, and whether the manganese salt can be used effectively as a powder strewn between the rows are matters well deserving of investigation. Indications at present are that a fairly late application gives better results than early treatment of the crop.

Reduction of Charges for certain Poultry Disease Services at the Veterinary Laboratory, Weybridge

THE Ministry wishes to notify poultry farmers that as from May 15, 1937, the charges for blood agglutination tests for bacillary white diarrhoea have been reduced from 2*d.* per bird to 1½*d.* per bird, with no discount for quantities. The charges for fowl pox vaccine have also been reduced by 30 per cent. to 1*s.* 9*d.* for 30 doses (minimum quantity supplied), and thereafter 6*d.* for 10 or part of 10 doses, e.g., 5*s.* 3*d.* for 100 doses and £2 10*s.* for 1,000 doses. The minimum charge of 1*s.* 9*d.* covers a supply of 30 doses, together with a scarifier and brush for applying the vaccine, and full instructions for use.

Payment must accompany all specimens and orders for vaccine. Cheques, postal and money orders should be made

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payable to "The Ministry of Agriculture and Fisheries" and crossed "Bank of England." Postage stamps cannot be accepted.

Communications relating to blood testing and the supply of vaccine should be addressed to the Director, Ministry of Agriculture and Fisheries, Veterinary Laboratory, New Haw, Weybridge, Surrey.

Interesting Birds: (4) The Blackbird

THE Blackbird, one of the commonest of all our birds, is too well known to need description. It is one of our finest songsters—in the opinion of many people the best of them all.

The Blackbird is especially subject to albinism. It is by no means uncommon to see specimens that are prettily pied with black and white, and pure white ones are sometimes seen.

The Blackbird's nest is built in a variety of situations, with little or no attempt at concealment. Large numbers of nests are destroyed annually by various means, but the species seems to be as common as ever it was. Two or even three broods of young are raised by one pair of birds in a single season. This fact no doubt offsets the high rate of mortality, and is an important factor in the maintenance of a steady Blackbird population.

It must be admitted that the Blackbird does a great deal of damage in the fruit season. It is very partial to cherries, and also to currants, gooseberries and other bush fruit. In many districts it is a decided nuisance in the fruit season, and, naturally, most gardeners and fruit growers dislike it. On the beneficial side, the Blackbird destroys numbers of noxious insects, slugs, and other pests. The Blackbird is, therefore, an example of a species that throughout most of the year is highly beneficial; but, for a limited period, and in certain circumstances, may do a good deal of harm. Where fruit crops can be protected by such means as netting or alarm guns, these methods are preferable to wholesale slaughter.

Tuberculosis (Attested Herds) Scheme (England and Wales).

As foreshadowed in the Statement of Agricultural Policy made by the Minister of Agriculture and Fisheries in the House of Commons on May 27 (see p. 210) the Minister has



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Blackbird and Nest

[Photograph copyright G. K. Yeate]

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amended the Tuberculosis (Attested Herds) Scheme (England and Wales) dated January, 1935, by the issue of a revised Scheme which supersedes it as from June 1, 1937. The purpose of the new Scheme, which adheres to the principles on which the earlier Scheme was based, is to encourage the addition of increased numbers of herds to the Register of herds officially certified to be tuberculosis free, by the offer of additional financial inducements to owners of cattle herds qualifying for a Certificate of Attestation.

The conditions which a herd must satisfy before a Certificate of Attestation will be issued and the herd entered in the Register of Attested Herds, kept and published by the Ministry, remain as heretofore, viz., the herd must pass an official test, and this test in turn will be applied only if the herd has passed the two preceding herd tests carried out by the owner's veterinary surgeon at the stipulated intervals without any reactors being found. The principal amendments contained in the new Scheme are as follows:—

(1) Any owner having a herd of cattle which has been tested with tuberculin and has been found to contain not more than a certain specified proportion of reactors (about ten per cent.) may, if the reactors have been disposed of, apply to the Ministry for financial assistance towards the cost of further tests (up to a maximum of four complete herd tests) with a view to completing the eradication of tuberculosis from his herd and applying for a Certificate of Attestation. The contribution payable by the Ministry in respect of each of these "assisted" herd tests will be at the maximum rate of 2s. 6d. per head of cattle tested plus a sum of £1 1s. 0d. per herd, but the contribution will in no case exceed the amount of the charges made by the veterinary surgeon who carries out the tests. It is intended that these assisted tests shall be carried out by a veterinary surgeon employed by the owner of the herd, but the arrangements for the tests must be submitted to the Ministry beforehand for approval.

(2) In any case in which a herd fails to pass the official test required before a Certificate of Attestation can be issued, the owner, instead of having his application rejected as at present, will have the opportunity of applying for further official tests at the expense of the Ministry up to a maximum of three complete herd tests (making four

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official tests in all). When the whole herd passes one of these tests a Certificate of Attestation will be issued.

(3) Herds which have been accepted for "assisted" tests or for additional official tests mentioned in the two preceding paragraphs will be known as "Supervised" herds and their owners will be required to observe the Rules set out in the 2nd Schedule to the Scheme, dispose of reactors, and disinfect the premises. These Rules vary somewhat from those applicable to Attested Herds but are designed with the same object, viz., to protect the herd from the risk of infection by contact with cattle which are on adjoining premises or which may be added to the herd.

(4) The interval required to elapse between any of the qualifying tests for attestation has been shortened to one of from 60 to 90 days, thus enabling herd owners to achieve attestation in a shorter time than formerly.

(5) Provision is made whereby official tests (other than those for the purpose of deciding whether a Certificate of Attestation may be granted in the first instance) may be carried out by the veterinary practitioners nominated by the Ministry. These are the tests required at certain intervals to satisfy the Ministry of the continued freedom of the herd from tuberculosis before a Certificate of Attestation is renewed. All official tests will be at the expense of the Ministry.

The direct advantages to herd owners of entering the Scheme of Attestation lie in the provision by the Ministry of free tests, together with a bonus of 1*d.* per gallon on all milk from the herd sold through the Milk Marketing Scheme. The advantages of owning a tubercle-free herd do not by any means end here. The wastage of cattle due to the ravages of tuberculosis is considerable and the Attested Herds Scheme affords a means of protection against such wastage. As proved at recent sales, animals coming from known tubercle-free herds command substantially higher prices than animals from herds in respect of which there is no such guarantee.

Applications for further information in regard to the Scheme should be addressed to the Secretary of the Ministry, Whitehall Place, London, S.W.1.

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Single-handed Hay Making

The following note has been contributed by Mr. T. S. PICK:

At the beginning of March last year, I was greatly worried as to how to collect hay single-handed from about 15 acres of land. I had recently purchased some more land, bringing my total up to 40 acres, and had failed to obtain assistance for the single man I employed who had come to me from a different part of the country. Much less did I anticipate being able to obtain temporary help in the hayfield, being a stranger in the district. I should add that I myself travel into town each day, and could at the most only give a little assistance in the evenings and on Saturday afternoons.

The " Preservation of Grass and other Fodder Crops " and other books had been studied in an attempt to solve the problem, but it seemed that all the schemes mentioned were unwarranted for so small an area. There was a short reference to baling, and I thought that if I could get a single-handed baling machine, I could arrange to bale, cart and stack the hay without assistance. I might also add that some helpful correspondence with the Institute for Research in Agricultural Engineering, Oxford, confirmed my impression that baling would be a good thing, without the extra inducement of single-handed operation.

I was extremely lucky, because one evening I happened to notice in a showroom window a small waste-paper baler, and, although it had a label on it warning the operator not to use it for straw or other fibrous material, I decided to purchase one as the price (£17) was well within that justified by 40 acres of land.

As it turned out, help in the hayfield was forthcoming, but I decided to use the baler myself, largely because I was of small value in the normal hayfield work, having had little previous experience. I found that, even with my inexperience and somewhat indifferent physical ability, I could bale continuously without effort at the rate of 5 bales per hour, including the time for carting the hay over a mile and stacking it in a Dutch barn.

Each bale measured 24 × 21 × 15 in. and contained between 45 and 60 lb. of hay, depending on its quality, with an average for moderately good meadow hay of 56 lb. per bale (6.5 cu. yd. per ton).

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The method of procedure was to hitch the baler, which was mounted on skids, behind a car and trailer, and move up between the windrows. Usually, 3 bales were made between each movement, and as the bales were made they were piled on to the trailer, which took a maximum load of 10 bales, after which the baler was unhitched and the load taken to the barn.

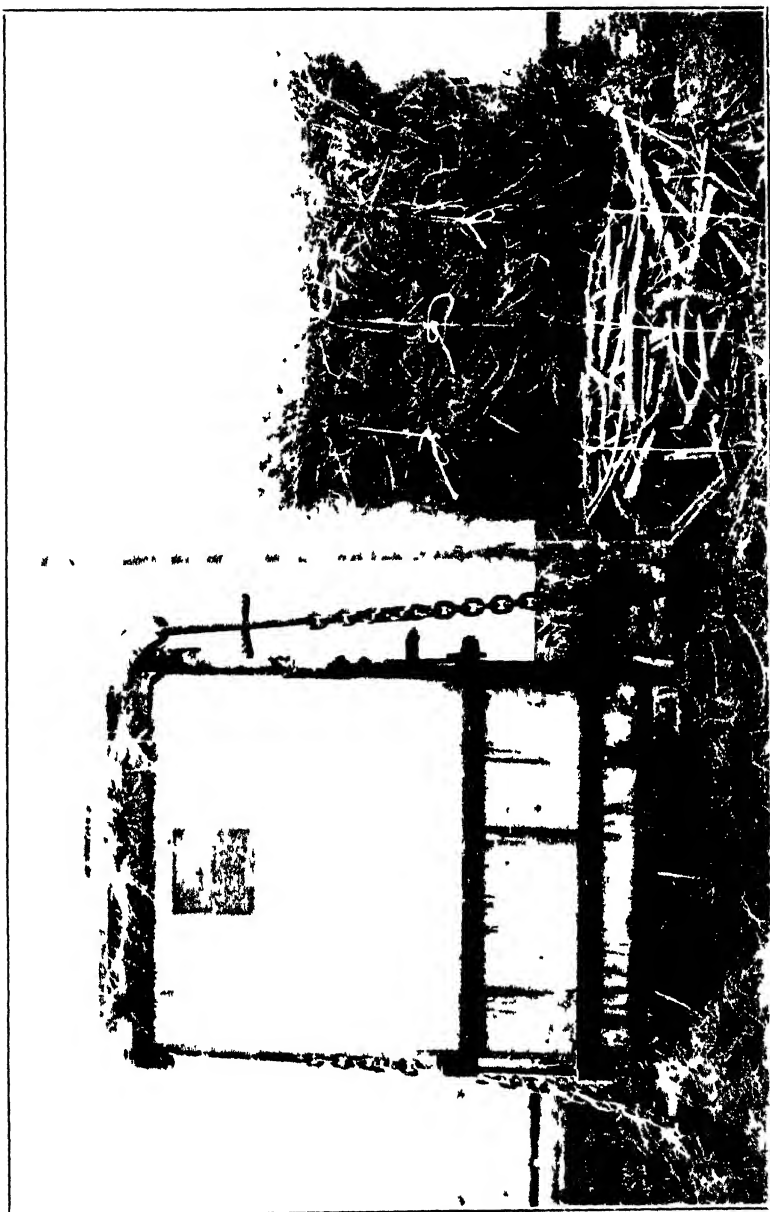
Towards the close of a day's work, the hay remaining on the field was collected into a pike to be baled at leisure at a later date. Probably an ideal method would be to use a tripod drying system, and bale from each tripod in turn.

In many instances baling was carried out on hay that was still too damp to stack in the normal way, as well as on one or two occasions when slight rain was falling. All the bales have turned out in good condition, slight mould occasionally occurring in the strata or layers between successive pressings in the baler.

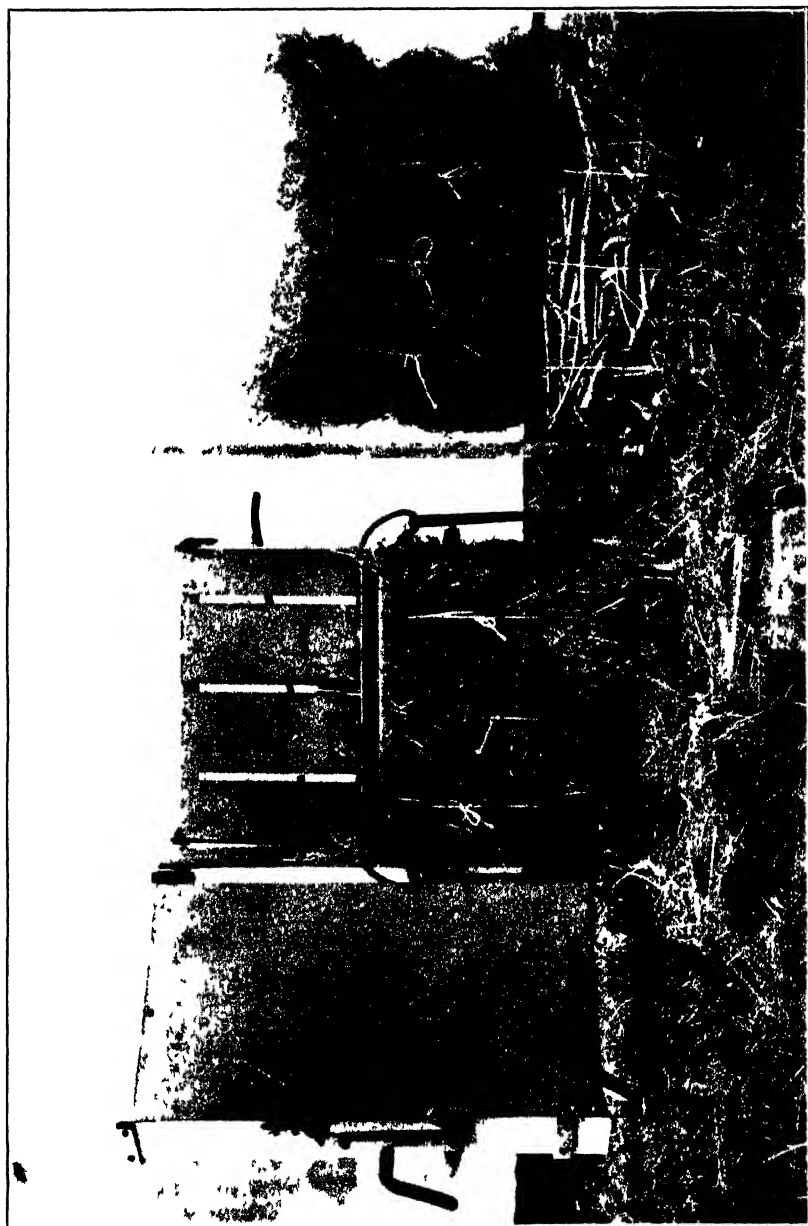
There is no need to emphasize the savings. Units of 56 lb. of hay in bundles half the size of a normal truss have been fed to the cows in the field, without the chaff associated with cutting hay out of a stack, so that the whole of it is cleared, leaving little or no trace as to where they were fed. There is the immediate economy of storage space, allowing for ventilating spaces, 8 cu. yd. only were needed per ton without having to wait for the pile to settle.

Working in all 43 hours on odd evenings and Saturdays, I had cleared and stacked over 5 tons of hay, and I would suggest that anyone more used to manual labour could have cleared this amount at least in 30 hours, so that an acre per day of average meadow could be dealt with single-handed, which is comparable with the time occupied per man in the normal method of carting and stacking. This, coupled with the ease of rationing and the ultimate saving of waste, storage space and labour during the winter months, might be attractive to other small-holders who do not feel justified in spending large sums in mechanical equipment.

One last word. The baler need not be idle in the other months of the year, because straw and other general litter can be squeezed into an extraordinarily small space for easy handling. As an example of the baler's general usefulness, I might add that it has recently been used on firewood, reducing 6 faggots of normal pea-stick size to a compact bundle of 3 cu. ft.



Waste paper biter used for bldm. hwy



West jet hole r use t for holding hvy the boiler op n

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World's Dairy Congress

THE official programme of the 11th World's Dairy Congress to be held in Berlin during the period August 22-28, 1937, has now been issued. It contains full information concerning the daily programmes and Congress rules, and also includes particulars of travelling facilities and accommodation in Berlin. Copies of the English edition, together with full information regarding the Congress, may be obtained on application to the Secretary, British Dairy Farmers' Association, 28 Russell Square, London, W.C.1.

At the daily sessions of the Congress, papers submitted by experts from all countries will be read and discussed, and opportunity will be provided for the exchange of views on scientific and practical experiences in the whole field of the dairying industry.

In connexion with the Congress an International Dairy Exhibition has been arranged, in which Great Britain will participate with a photographic display illustrating various aspects of the dairying industry in this country, including modern marketing features and educational and research activities.

During the Congress, excursions will be made to centres of interest in the neighbourhood of Berlin, and afterwards tours of inspection of the important German milk-producing areas will be arranged, including visits to dairy research institutes, prominent milk processing establishments and dairy equipment factories.

17th International Congress of Agriculture at the Hague

On the recommendation of the Agricultural Research Council, His Majesty's Government has appointed Sir Daniel Hall, K.C.B., LL.D., F.R.S., and Mr. E. J. Butler, C.M.G., C.I.E., D.Sc., F.R.S., Secretary to the Council, as official delegates from the United Kingdom to the above Congress. As recorded in the JOURNAL for February last, this Congress is being held from June 17 to June 21 at the Hague, under the patronage of H.M. the Queen of the Netherlands.

Further information may be obtained from the Secretariat, Rue de Bellechasse 18, Paris (VIIe).

STATEMENT ON AGRICULTURAL POLICY

In reply to a question by Mr. Attlee in the House of Commons on May 27, 1937, Mr. Morrison (Minister of Agriculture) said he was glad of this opportunity to make a statement. Proceeding, Mr. Morrison said:—

The Government have very carefully considered the position of agriculture from the points of view of the welfare of agriculture itself, national defence, and the importance of maintaining continuity in our agricultural policy that is designed to ensure maximum supplies for the consumer consistent with reasonable remuneration for the producer. The Government have in the past initiated proposals for dealing with particular agricultural products. This side of the Government's policy will continue and I hope shortly to announce proposals for the future of the milk and pig industries. There are, however, certain fundamental matters with which I wish to deal in the following statement.

In regard to defence, I should like at the outset to stress the following considerations. The two objectives—of producing the maximum quantity of food to meet our requirements in time of war, on the one hand, and of the efficient development of our agriculture in time of peace, on the other—not only demand very different methods but, to a material extent, are opposed to each other. In particular, a drastic policy of food production for war purposes would entail the ploughing up of an extensive area of our grassland for the purpose of growing cereals and other crops for human consumption. In peace time, however, livestock husbandry, which is the foundation of our agriculture, is naturally based on a grassland system on account of the physical and climatic advantages which favour it. The Government have had to determine where, between these two objectives, the path lies which, on balance, it would be wise to follow.

In the opinion of the Government, to put agriculture on a war-time footing with all the regulations, the regimentation of the farming community, and the heavy costs that it would unavoidably involve, would not be practicable at the present time; nor in their opinion is the situation such as to require the adoption of this course in time of peace. The Government are equally satisfied that considerations of national defence would not justify a policy in peace time of stimulating agricultural production to such a pitch that the country

STATEMENT ON AGRICULTURAL POLICY

would be faced with a highly artificial situation which would, sooner or later, have to be liquidated if the emergency did not arise. Such a policy would be costly to build up and costly to close down. Moreover, farmers themselves will have a vivid recollection of the disorganization and uncertainties which followed the repeal of the Corn Production Acts in 1921, and the Government have no wish to put them in such a position again.

Having regard to these considerations, the Government are satisfied that the best course in the general national interest is to continue their efforts to improve the general prosperity and efficiency of home agriculture, and in particular to promote an increase in the fertility and productivity of our soil. The proposals which I shall now outline are so designed that should an emergency arise we should be in a position immediately to take advantage of improved fertility but, should it not arise, we should be increasing the productivity of our land and stock by means which are consistent with, and not opposed to, the normal development of our agriculture on economic lines in time of peace.

To achieve this object, the Government propose that the following measures should be taken:—

Liming. One of the most serious deficiencies of the land of this country arises from failure to maintain the old practice of applying lime to the soil. Due to the long depression, farmers have been unable to bear the cost. The result has been felt not only in diminished fertility, but also in the lack of elements essential to healthy plant and animal life. The Government propose to assist farmers in raising the fertility of the soil by increased use of lime. They also consider it desirable to secure increased application particularly to grasslands, of basic slag which, like lime, is available from home sources and has an enduring effect upon the soil. They propose that for a limited period of years the cost to the farmer of lime and basic slag should be reduced by approximately 50 per cent. and 25 per cent. respectively. The object of these proposals is not only to make good past exhaustion of soil fertility in many parts of the country, but to build up reserves of fertility, valuable in peace time, and immediately available to meet the heavy demands upon it which might be made in time of war.

Wheat. It is proposed to raise the limit of the "anticipated supply" under the Wheat Act, 1932, from 6,000,000 to

8,000,000 quarters and thereby to stimulate an increase in the wheat acreage. In present circumstances this involves no cost but will give valuable additional insurance to wheat growers in the United Kingdom.

Oats and Barley. The Government propose also to introduce a scheme in respect of oats and barley which will be in the nature of an insurance against low prices. It will apply only to those growers of oats and barley in the United Kingdom not receiving benefit under the Wheat Act. For the purpose of the Oats Scheme there will be a standard price of 8s. per cwt., and a national standard acreage will be determined. A payment will be made to the grower in respect of each eligible acre. This payment will be calculated on the basis that, on the average, about 6 cwt per acre are sold off farms. The payment will therefore be equal to six times the difference between the standard price of 8s. per cwt. and the average market price over a period. If the total acreage eligible for subsidy exceeds the national standard acreage, the rate of payment will be reduced proportionately. In the case of barley the principle of a national standard acreage will also apply, and it is proposed that payment will be at the same rate per acre as that for oats. At the prices prevailing for oats at the present time no payment would be made, but it is estimated that if prices were to fall to the lowest level of recent years the Exchequer liability in any year, in respect of both oats and barley, would not exceed £1,750,000. In no case will the payment exceed £1 per acre.

Drainage. It is proposed to extend the system of Exchequer grants for land drainage. In England and Wales grants will be given for works to be carried out by the lesser Drainage Authorities concerned. In Scotland the rate of grant for drainage under the scheme administered by the Department of Agriculture for Scotland will be increased. It is hoped that with the aid of these grants it will be possible, in any one year, without interfering with the labour required for agriculture, to undertake essential works costing up to £450,000.

Grassland Improvement. In a policy aimed at raising the fertility and productivity of our soil the improvement of our grassland must be an objective of fundamental importance. Grass forms one of our greatest natural resources and it is in the national interests that it should be more fully and profitably utilized in time of peace and be a reservoir

STATEMENT ON AGRICULTURAL POLICY

of fertility for an emergency. By the Livestock Industry Bill at present before Parliament and the arrangements for regulating supplies of livestock and meat to this market the Government are seeking to promote the prosperity and efficiency of the livestock industry. The Government believe that this measure and those now proposed for drainage and for the increased use of lime and basic slag will lead to a marked improvement in the grassland of this country. The Government are also alive to the potentialities of dried grass as a possible addition to home-grown supplies of feeding stuffs. They are accordingly encouraging further experiments in grass drying.

Eradication of Animal Diseases. The Government also propose to initiate a large-scale and more comprehensive campaign for the eradication of animal diseases in Great Britain. Our object is to improve the health of our livestock and increase agricultural productivity by seeking to eliminate what is perhaps the worst of all forms of wastage and economic loss in agriculture. In the first instance, efforts will mainly be directed to the eradication of diseases among cattle. The scheme will involve an additional charge on the Exchequer of about £600,000 per annum for the first four years. It will, however, involve centralization of public veterinary services and as against the increased cost to the Exchequer, the expenditure by Local Authorities will be reduced by about £170,000. Parliamentary authority will be required for these proposals. The Government are anxious, however, to lose no time in developing the existing schemes of control of disease and accordingly, I am arranging at once to amend the Attested Herds Scheme under the Milk Act, 1934, by providing additional assistance in England and Wales, as has already been done in Scotland, to owners of dairy stock who are desirous of eradicating tuberculosis from their herds. This revised scheme will become operative on June 1 next.

In the opinion of the Government, the proposals which I have outlined, by increasing the productivity of our agriculture, not only will enable it better to meet the situation in the event of war, but will be a substantial aid towards raising efficiency, lowering costs and establishing the industry on a sounder economic foundation in time of peace.

The necessary legislation to give effect to these proposals will be introduced at the earliest possible moment.

COUNTY COUNCIL SMALL-HOLDINGS IN DORSET AND HAMPSHIRE*:

III. MARKET-GARDEN AND FRUIT SMALL- HOLDINGS

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The Sample. This section is based on information obtained from 81 smallholders, 78 in Hampshire and 3 in Dorset. With a few isolated exceptions the majority of the small-holdings were concentrated in groups situated within easy access of the large towns on the south coast of Hampshire. The largest group was situated between Southampton and Fareham, around Titchfield, Botley and Fareham. The second largest group was on the outskirts of Bournemouth.

These small-holdings can be divided into three classes according to the type of production carried on; 40 can best be described as market-garden holdings, 21 as strawberry holdings and 20 as a mixture of market-garden and strawberry holdings.

Type of Production. The total area of the 40 *market-garden holdings* was 386 acres. Of this, 309 acres were under market-garden crops, 29 acres under fodder crops, 18 acres under fruit and 30 acres either taken up by buildings and roads, or utilized as poultry runs or as grazing ground for a horse. On only a few holdings was any fixed rotation of crops practised, although in nearly all instances care was taken to avoid growing the same crop on the same piece of land twice in succession. The land was cropped as many times as possible, though intercropping was not general. Altogether, 17 different sale crops were grown on these 40 holdings. In order of importance they were as follows:—

Spring and winter cabbage, early potatoes, sprouts, savoys, brocoli, cauliflowers, peas, broad beans, runner beans, lettuces, carrots, parsnips, beetroot, radishes, onions, rhubarb, strawberries.

Only 4 holdings had fewer than 5 different crops per holding, 23 had 5-9 crops, and 13 had 10 or more types of crops. In addition to these crops, 11 smallholders kept pigs, 5 kept poultry, and 8 kept pigs and poultry.

* The first of these articles appeared in the issue of this Journal for April, 1937, and the second in that for May.

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The total area of the 20 *mixed fruit and market-garden holdings* was 147 acres. Every holding had roughly half its acreage under market-garden crops and half under fruit, mostly strawberries. Thus, of the total 139 acres of crops grown, 67 acres were under fruit, 62 acres under market-garden crops and 10 acres under fodder crops. The market-garden crops grown showed the same diversity of type as those mentioned above. In addition to strawberries, currants and raspberries were also grown. Only 7 holdings had fewer than 5 types of product, 11 holdings had 6-9 types, and 5 had 10 or more types. In addition, 3 smallholders kept poultry, 2 kept pigs, and 5 kept both pigs and poultry.

The total area of the 21 *strawberry holdings* was 110 acres, of which 79 were under strawberries, 15 under market-garden crops, 10 under fodder crops, and 6 under roads, buildings and grass. Many of these smallholders, especially the smaller ones, cropped the land continuously with strawberries. Others gave the land periodic rests, growing either potatoes or cabbage in between. In some instances a crop of mustard was grown and ploughed in as green manure. Only very rarely was any land left fallow. Besides strawberries, the following crops were also grown: currants, raspberries, gooseberries, apples, potatoes and cabbage. Several of the smallholders stated that they were inclined to increase their acreage of market-garden crops at the expense of the strawberry area. In this group, 7 smallholders had nothing besides the strawberry crop, 11 had from 2-4 different crops, and only 3 had 5 or more crops. In addition, 5 smallholders kept pigs, and 1 kept poultry.

On all 81 holdings livestock were of minor importance, and, as indicated above, 28 holdings kept no livestock at all. The total numbers of livestock on the remaining 53 holdings at the time of the survey were 41 horses, 61 sows, 415 other pigs, and 3,196 poultry. On 52 holdings horses were not kept, the smallholders hiring horses and implements for the heavier cultivations either from neighbouring farmers or from the larger smallholders. Sometimes the horses and implements only were hired, the smallholder himself supplying the manual labour. Pigs were kept on 31 holdings, and they were valued as much for the manure they produced as for the revenue they brought in; they also provided a useful means of turning waste produce to profitable use. Poultry were kept on 29 holdings but only on 22 of them were they

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really regarded as commercial enterprises deserving of special attention.

Many of the smallholders expressed the view that they would keep more livestock if they had larger acreages and suitable accommodation, mostly because of their importance as a source of much needed farmyard manure. At the time of the survey, 52 smallholders used dung, and 32 of these relied entirely on purchased supplies. The others stated that they could not afford to buy dung, partly because of its high price and partly because of the inferior quality of the available supply. It was found that on 35 holdings both dung and artificial manures were used, 18 holdings used artificials only, 17 holdings used dung only and 11 holdings used no manures of any kind.

Disposal of Produce. Information about the disposal of market-garden crops was obtained from 50 smallholders. Retailing was practised by 19, and 31 sold their produce wholesale. Of the latter, 11 sold direct to retail shops and 20 sold in the open market, 9 doing the selling themselves and 11 selling through salesmen working on a commission basis. The towns in which the produce was sold and the numbers sending to each town were as follows :—

16 to Portsmouth.	3 to Fareham.
13 to Southampton.	1 each to Poole, Basingstoke,
10 to Bournemouth.	Bishops Waltham, Titchfield,
3 to Gosport.	Wimborne.

The strawberry growers disposed of their crops either by selling direct to wholesalers or by selling through commission agents. The destination was very varied and far flung, but the most important market was Covent Garden.

Capital Invested. Complete financial data were obtained from 51 holdings only, and the data apply to the growing and sale of the 1935 crops. It will be convenient to divide these 51 holdings into the following three groups :—

	<i>No. of holdings</i>
Group I. Market-garden holdings with livestock ..	19
Group II. Market-garden holdings with no livestock	13
Group III. Fruit holdings	19
	—
	51
	—

The average capital invested per acre on each of the three groups of holdings is shown in Table VI. The figures do

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not show the total investment, for nothing has been included for tenant right and cultivations on growing crops.

TABLE VI
CAPITAL INVESTED PER ACRE ON 51 MARKET-GARDEN AND
FRUIT HOLDINGS

		Group I			Group II			Group III			All Groups		
		£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Implements	..	3	4	0	2	12	6	1	16	0	2	7	10
Horses	..	1	2	6	1	0	0	6	6		17	4	
Other livestock	..	3	16	10	—			1	14	6	2	5	6
Total	..	8	3	4	3	12	6	3	17	0	5	10	8

Further, capital invested in motor vehicles has also been excluded, for it applied to only a few holdings and its inclusion would not give such a representative picture. Thus the inclusion of 4 motor vehicles owned by 3 smallholders in Group I and by 3 smallholders in Group II would raise the average investment for these two groups by £1 12s. 3d. and 18s. 9d. per acre respectively. Again, the inclusion of glass-houses owned by 1 smallholder in Group I and by 3 smallholders in Group II would have raised the average investment of these two groups by £3 7s. 4d. and £10 6s. 3d. per acre respectively.

Expenses. The expenses per acre and per cent. for each of the three groups are shown in Table VII.

The average expenditure of £45 11s. 2d. per acre illustrates the much greater intensity of cultivation on these small-holdings compared with that of the dairy small-holdings already described. As with the dairy holdings it includes an estimated figure for family labour assessed at current wages rates. The rental figure shown also includes the rent of houses in order to make the statement comparable with that already given for the dairy small-holdings. There is considerable variation between the three groups, both as regards total expenditure, and the relative importance of the various items.

The most important single item of expense on all three groups, however, is labour, accounting as it does for 53 per cent. of the total expenditure. The total labour cost was highest for the fruit holdings, and lowest for Group II holdings. In all instances family labour was more important than hired labour.

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TABLE VII

EXPENSES PER ACRE AND PER CENT. ON 51 MARKET-GARDEN
AND FRUIT SMALL-HOLDINGS

<i>Expenses</i>	<i>Group I</i>	<i>Group II</i>	<i>Group III</i>	<i>Average, all Groups</i>
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Rent and rates ..	5 19 9	6 13 10	6 16 6	6 6 2
" " per cent.	12·8	16·9	13·9	13·8
Family labour ..	12 19 3	14 14 9	16 1 3	14 5 8
" " per cent.	27·6	37·3	32·8	31·4
Hired labour ..	11 16 0	6 7 9	10 9 2	10 1 8
" " per cent.	25·2	16·2	21·3	22·1
Feeding stuffs ..	6 3 9	1 1 4	2 6 8	3 16 1
" " per cent.	13·2	2·7	4·8	8·4
Livestock ..	10 5	—	12 8	9 0
" " per cent.	1·1	—	1·3	1·0
Artificial manures ..	1 6 6	1 10 2	1 13 0	1 9 4
" " per cent.	2·8	3·8	3·4	3·2
Dung ..	16 1	1 14 0	1 0 4	1 1 9
" " per cent.	1·7	4·3	2·1	2·4
Plants and seeds ..	2 19 10	1 18 5	17 9	2 1 5
" " per cent.	6·4	4·9	1·8	4·5
Straw ..	13 8	7 0	1 1 6	14 3
" " per cent.	1·5	0·9	2·2	1·6
Hire of machinery and hired cultivations ..	13 3	17 4	10 6	13 6
" " per cent.	1·4	2·2	1·1	1·5
Implements—upkeep ..	3 10	4 2	4 6	4 2
" " per cent.	0·4	0·5	0·4	0·5
Transport ..	2 3	4 4	3 5 10	1 1 2
" " per cent.	0·2	0·5	6·7	2·3
Packages ..	11 9	8 6	2 16 8	1 3 10
" " per cent.	1·3	1·1	5·8	2·6
Other expenses ..	2 1 4	3 9 0	1 3 10	2 3 2
" " per cent.	4·4	8·7	2·4	4·7
Total ..	46 17 8	39 10 7	49 0 2	45 11 2
" " per cent.	100·0	100·0	100·0	100·0

In Group II and Group III the second most important item of cost was rent and rates, but in Group I the second place is taken by the cost of purchased foods. The figure for purchased food in Group II was incurred in buying horse-feed, while the corresponding figure in Group III was incurred almost entirely by 3 smallholders who kept pigs. (These 3 smallholders also account for the relatively high item for livestock purchased in this group.)

The other expenses show considerable variation from group to group, and this is explained by the difference in the

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nature of the production. Thus the presence of livestock in Group I partly explains its lower expenditure on manures. Expenditure on plants and seeds is higher for the market-garden holdings, but expenditure on straw is highest for the fruit holdings. The high expenditure for transport and containers shown for the fruit-growing group indicates the much higher marketing costs involved.

Receipts. The receipts per acre and per cent. for each of the three groups are set out in Table VIII.

TABLE VIII
RECEIPTS PER ACRE AND PER CENT. ON 51 MARKET-GARDEN
AND FRUIT SMALL-HOLDINGS

<i>Receipts</i>	<i>Group I</i>	<i>Group II</i>	<i>Group III</i>	<i>Average, all Groups</i>
	<i>£ s. d.</i>	<i>£ s. d.</i>	<i>£ s. d.</i>	<i>£ s. d.</i>
Market-garden crops ..	33 19 4	34 3 9	2 15 9	25 1 3
" " per cent.	64.2	89.8	5.5	51.5
Fruit crops ..	4 15 2	3 15 6	45 5 6	16 3 6
" " per cent.	9.0	9.9	89.0	33.3
Pigs ..	9 6 0	—	2 8 9	5 0 3
" " per cent.	17.6	—	4.8	10.3
Eggs and Poultry ..	3 12 4	2 6	1 4	1 14 6
" " per cent.	6.8	0.3	0.1	3.5
Miscellaneous ..	1 6 0	—	6 0	13 3
" " per cent.	2.4	—	0.6	1.4
Total ..	52 18 10	38 1 9	50 17 4	48 12 9
" " per cent.	100.0	100.0	100.0	100.0

The average figure of £48 12s. 9d. per acre is inclusive of the value of livestock products consumed by the family. This figure was, however, very small, amounting to only 6s. 3d. per acre for all the holdings. In Group I, 15 holdings produced their own eggs and poultry supplies, while in Group II, 3 holdings, and in Group III, 2 holdings kept a few head of poultry to supply home needs. Unfortunately, it was impossible to put a figure for the value of the vegetables and other crops consumed by the families of the smallholders. Most of the smallholders stated that they produced their own vegetables and potatoes but were unable to give any quantitative data of supplies.

The Table illustrates well the greater diversity of receipts in the first group of holdings, and there is little doubt that

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this diversity was an important factor, not only in increasing the total receipts, but in spreading the receipts over the year. In most of the holdings in the third group the great bulk of the receipts was derived from the strawberry crop and was, therefore, obtained during the very short period of some 3 weeks in the summer. This dependence on one crop and the concentration of the receipts to such a restricted period is undoubtedly a very serious matter for the smallholders concerned.

The figure for miscellaneous receipts shown for Group I and Group III is explained by the fact that some of the smallholders in these groups did some outside work. Thus, in Group I, 2 smallholders did some haulage, 2 hired out horses and 1 hired out implements. Again, in Group III, 3 smallholders did a little outside labour, although they were mostly employed on their own holdings.

Profits and Losses. The average profit, calculated in the usual way, per acre and per holding for each group was as follows:—

	<i>Profit per Holding</i>			<i>Profit per Acre</i>		
	£	s.	d.	£	s.	d.
Group I	41	10	0	5	6	3
Group II	—	9	16	—	1	11
Group III	9	6	4	1	18	0
All Groups	16	19	8	2	12	0

The above figures illustrate the superior position of the more diversified holdings in Group I. As in the corresponding table for the dairy holdings, however, they tend to exaggerate the position. The size and distribution of profits and losses for each group is shown in Table IX, which provides a better indication of the actual position.

When family labour was charged at current wages rates, only 51 per cent. of the holdings showed a surplus income, but when no such charge was made, all except 9 of the holdings (i.e., 90 per cent.) showed a surplus. Table X shows the average "family income" per holding and the average "income" per person employed for each of the three groups.

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TABLE IX

PROFITS AND LOSSES ON 51 MARKET-GARDEN AND FRUIT
SMALL-HOLDINGS

	Group I	Group II	Group III	All Groups
<i>Profit per holding :</i>	No.	No.	No.	No.
Over £100	3	—	2	5
From £50 to £100	3	2	1	6
From £25 to £50	3	1	3	7
Less than £25	2	3	3	8
				51.0 per cent.
<i>Loss per holding :</i>				
Less than £25	2	1	4	7
From £25 to £50	3	4	5	12
Over £50	3	2	1	6
				49.0 per cent.

TABLE X

AVERAGE "INCOME" PER FAMILY AND PER PERSON ON 51
MARKET-GARDEN AND FRUIT SMALL-HOLDINGS

	Average Family Income	Average Income per Person
	£	£
Group I	143	98
Group II	80	70
Group III	88	80
All groups	106	86

The figures in Table X again help to emphasize the comparative superiority of the diversified group of holdings. While it is not possible to ascribe success to any one factor, the evidence does suggest that there is a greater chance of success for those smallholders who do not depend too exclusively on the production of only one or two commodities. In particular, the introduction of small livestock into the farming system has undoubtedly improved the financial position of the smallholders concerned during the period under review.

(To be concluded.)

SHEEP BLOWFLY INVESTIGATIONS

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and

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Introduction. The importance of the sheep blowfly problem needs no emphasis ; all owners of sheep in this country are only too familiar with the ravages of this pest. It is no new problem, as is sometimes believed, for the writings of Fitzherbert^{1*} (1534) and Tusser² (1557-1585) show that the symptoms of attack by maggots were well known at that period. Although in many districts the actual annual loss by death is usually small, this is due only to the care and vigilance of the owner or shepherd, whose time may be almost fully occupied in examining and dressing sheep that have been struck. To the loss of time thus caused must be added the continued disturbance and irritation to which the sheep are subjected. Since, in an abnormal season, such as 1936, up to 30 or 40 per cent. of the sheep may be struck, the actual loss in live weight becomes considerable, and is witnessed by the number of attacked lambs still in poor condition at the end of the autumn. On rough grazings, particularly if infested with bracken, actual deaths may be numerous, as the sheep when struck seek the shade and it is often impossible to find them.

During recent years, the problem has received the attention of research workers in Australia,³ South Africa,⁴ and Great Britain.^{5, 6} In all instances the work has been commenced by entomologists, but soon, as it proved in North Wales, it has become apparent that a solution to this complex problem cannot be found by approaching it from one angle alone. It is true that it is the insect that has to be controlled, and that a detailed knowledge of its structure, life-history and habits must be obtained. When, however, we ask the questions " Why does the sheep blowfly—which is normally a carrion feeder—attack *live* sheep? What conditions produce the attraction, and how can these be counteracted? " we soon find the problem extending into the fields of biochemistry,

* For references see p. 230.

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animal husbandry, and even bacteriology. The sheep blowfly problem, therefore, must be added to the growing list of investigations where joint study by a team of research workers from the different branches of science is essential if progress towards a satisfactory solution is to be expected.

As the result of financial assistance from the Agricultural Research Council, which has permitted addition to the laboratory facilities and the establishment of an experimental flock of sheep for these studies, it has been possible to develop the investigations along these lines.

Since, at the onset, the investigation of a complex problem like sheep blowfly attack must be directed to give information mainly of a fundamental character, it cannot be expected that results having immediate practical application will be rapidly forthcoming. Thus, this article is not intended to give an account of a final efficient treatment for the pest, but aims, at this stage, at giving certain results which it is believed have a real bearing on the problem and should be known to sheep farmers generally.

Species of Fly. There is a general impression among sheep farmers that at least two species of flies are involved, viz., those having small maggots which tend to burrow down into the skin, and the larger maggots which wander away more readily. This impression has not been substantiated, for, both by a survey of the species involved when farmers were invited to send in maggots from live sheep, and by numerous instances of maggot attack since the survey of 1928, it has been established that, with very rare exceptions, only one species—the greenbottle fly (*Lucilia sericata* Meig.)—is involved. The belief that two species attack sheep has probably arisen from the change in the habits of the maggots of *Lucilia sericata* at different stages. The smaller young maggots are ravenous feeders and tend to pass down to their food; the larger, older maggots are preparing to pupate in the soil, and, therefore, move away from the fleece more readily. The exceptional cases mentioned include the common bluebottle fly (*Calliphora erythrocephala*), the maggots of which have been taken in two advanced cases of attack where it was present with maggots of the greenbottle fly. Maggots of the bluebottle have not been taken alone on sheep. Another female fly, believed to be the species *Lucilia caesar*, was found last summer egg-laying on an already

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attacked sheep. Recently, too, Macleod⁷ has found another species, *Phormia terrae-novae*, attacking sheep in a single district in the West of Scotland.

Development of Maggot Attack. The life-history of *Lucilia sericata* on carrion has been studied by many workers, but, in order to present a complete story in this paper, a summary is given of the development on sheep.

(i) *Egg-laying*.—The gravid blowflies do not lay eggs indiscriminately on any sheep, or even on any part of the sheep, but the flies are definitely attracted to a particular sheep, and select a particular spot on the sheep in which to lay eggs. (The nature of the attraction will be discussed later.) The fly, on arrival, usually spends a few minutes selecting the site in which to lay. It walks around pushing out its proboscis or mouth, tasting and feeding on any liquid material near. Should it encounter anything distasteful, as, for instance, an arsenical poison bait, it will fly away and will not lay eggs. If it finds conditions favourable, it projects its ovipositor or egg-laying tube deep into the wool, and lays a batch of about 100 to 150 eggs. As many as 30 egg-laying females have been counted on a single sheep that had a small batch of maggots feeding and supplying the attraction. Often when a favourable site is found the fly is so persistent in its effort that even pushing away by hand will not prevent its return for egg-laying.

(ii) *Hatching*.—Whether or not eggs thus laid in the fleece will hatch, depends almost entirely on the humidity around them. The site must be practically saturated with moisture if the eggs are to develop and hatch. In a moist situation on the sheep the eggs hatch in about 9 hours. Quite commonly, however, eggs laid on sheep fail to hatch, or, if they hatch, the young maggots soon dry up. For instance, when the ewes of the experimental flock were examined on May 26, 1936, it was found that eggs were present on 12 out of 68 sheep, but, owing to the dry conditions, maggot attack only developed in 2 instances. Thus, during a spell of dry weather, when very few sheep are attacked by maggots, it does not follow that the blowflies are absent, or even that the sheep have not been blown; the eggs may have dried up.

(iii) *Feeding and Growth of the Maggots*.—The newly-hatched maggots tend to congregate in a small, moist cluster, and, as such, pass down the wool fibres to the skin. They can only grow slowly on excretory products in the wool, but, normally, their rapid movements on the skin surface causes inflammation and exudation of serum from the skin, this exudate providing ample food for the young maggots. Growth is slower when feeding on serum compared with carrion. The maggots can continue to feed on serum without actually penetrating the skin, and this often happens under wet conditions, when they can wander over the body.

Thus, the period of development of maggots on the sheep may vary from about 70 hours, when the flesh is quickly penetrated, to 83 hours, when the maggots feed mainly on serous exudation.

It is seldom that a severe attack of maggots originates from a single batch of eggs. The usual procedure is for the young maggots of the first batch to start feeding, and then the excreta from these, which is particularly attractive to gravid females, attracts more blowflies to lay masses of eggs near the feeding maggots. Under the moist conditions, and with favourable food already present, the newly-hatched maggots from these later eggs soon aggravate the situation, causing the attack to

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spread and become acute. This difference in age results in small and large maggots being present on the same sheep.

The maggots keep close to the skin while feeding, but when fully fed they wander about in preparation for passing out of the fleece and falling to the ground to pupate.

(iv) *Pupal Stage*.—Once on the ground, the maggots rapidly tunnel into the soil, where during the summer months they pass into a stationary, reddish-brown, barrel-shaped, pupal stage about $\frac{1}{2}$ in. long. The duration of the pupal stage varies with soil temperature, but, in the summer months lasts about 15 to 21 days, after which the flies emerge. In the autumn, the maggots that fall from the sheep do not pupate at once, but remain as maggots in the soil until March, when they come to the surface to pupate. It is mainly in the maggot stage in the soil that this pest spends the winter, and hibernating maggots have been collected in frozen soil, which, on thawing, has yielded live maggots.

(v) *Adult Stage*.—The flies, when they emerge from the pupal case, need water, and will soon die under dry conditions. Provided with a small quantity of water, such as droplets of dew, they can soon search for nutritive liquid food found in sugary products of flowers and carrion. There is evidence that the males may search for a different source of food from that sought by the females. The stink-horn fungus, for instance, is often found in woods smothered with blowflies feeding on its slimy surface, but in one instance all proved to be males. It has been shown that the female must have a meal on carrion or animal food before it can lay eggs.⁸

The life of the adult fly under caged conditions, ranged from 28 to 89 days, and in this country there are 4 generations each year.

Destruction of Maggots. It is quite a common practice for shepherds when attending to sheep to rub out the maggots with the shears before applying any treatment, believing that maggots thus rubbed out die of starvation away from the sheep. Unfortunately, this does not happen, for when such maggots were collected and put in soil with no further supply of food, over 90 per cent. proved to have had sufficient food before being rubbed out to be able to develop into flies. (Any shepherd can test this for himself by placing some maggots rubbed out into a tin containing soil or sand and keeping them in a warm place for about a fortnight.) Since all these maggots will be those of the sheep blowfly (*Lucilia sericata*), and since they are likely to be rubbed out in a field where the flock is grazing, it is clear that such maggots will provide an important source of blowflies, which will be ready to attack the sheep within less than a month's time. It is, therefore, most important that shepherds should realize this and apply any treatment *before rubbing out the maggots*, or make sure that the maggots are killed. (Method of treatment is dealt with later.)

Nature of Attraction. We must now turn to the question "What attracts the sheep blowfly, normally a carrion fly, to the *live* sheep?" The answer that suggests itself, owing to

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the frequency of attacks on the hind quarters, is that sheep-dung is the attraction. On further inquiry, and also by experiment, it is found that sheep-dung lying on the field, or in experimental cages, offers no attraction for the egg-laying flies. Further, there are many cases of attack that take place on the shoulder or back, away from wool contaminated with dung. Such observations led to a careful investigation of the nature of the attraction. It has now been established^{9, 10} that the nature of the attraction is two-fold. Firstly, there must be present "products of putrefaction". For instance, when a 2 per cent. solution of ammonium carbonate, or 0.02 per cent. of indole is placed on a healthy sheep, female blowflies, ready to lay eggs, have arrived on the treated part at the rate of 30 in half an hour. Strangely enough, however, these materials are not attractive when placed *away from the sheep*. Thus, it is clear that a second factor, which at present we can only describe as the "sheep factor," plays an essential part in this dual attraction. The exact nature of this "sheep factor" is the subject of further research. Since the factor termed "products of putrefaction" can undoubtedly be supplied by dung, all methods of cleaning up the hind quarters of the sheep must form an important part of any method of combating this pest. *Crutching*, which involves the shearing of the wool from above the tail, and around the hind legs of the sheep—a method commonly used in Australia—is seldom practised extensively in this country and could be developed with advantage.

As already indicated, dung is not the only source of the factor "products of putrefaction". The nature of the attacks on apparently clean parts of the body is more complicated. There is evidence that in Welsh sheep, at least, a certain "wool condition" predisposes to attack. In Australia, this condition has been referred to as "wool rot", and various grades have been described in Merino sheep.³ The nature of the origin of this condition is being investigated, but a brief description is given here so that farmers may examine their sheep to see to what extent such conditions are common in their flocks. Normally, the wool grease and products of excretion of the skin are distributed uniformly through the wool, so that, if the wool is parted, there is no indication of colouring or accumulation of waxy products. When this wool condition is present, however, these products

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appear to remain in the form of a crusty layer at the base of the wool. As the wool grows, this crusty layer passes up with the wool and ultimately appears on the outside of the fleece. There is usually a matting of the wool when this condition exists, with the result that moisture penetrates easily. We have observed that blowflies will select such a site for egg-laying and will thrust the eggs actually into the crust. It is of interest to record that one Welsh ewe and one Southdown cross ewe purchased in September, 1935, were, because of this wool condition, the first to be attacked by maggots in 1936, and the flies had blown the particular area where the wool condition existed. It should be recorded that the ram lamb of the Southdown cross ewe also showed this wool condition.

That such wool condition is not uncommon among flocks is seen from the following figures:—

Experimental flock (April) of 68 ewes	..	..	4 severe, 11 slight.
Welsh Mountain ewes, Aber (June), of 121 ewes	..	6	„ 22 „

The Problem of Control. A solution to the problem of the control of sheep maggot attack is being sought along the following lines:—

1. **HUMIDITY IN THE FLEECE.** It has been mentioned frequently in this article that both eggs and young maggots are particularly susceptible to dry conditions. In fact, it is probable that, owing to the ease with which eggs dry up, there are at least as many instances of unsuccessful development of eggs following egg-laying on sheep as there are of successful development of maggot attack. It has been shown that, at the temperature of the sheep's body, eggs and young maggots require over 90 per cent. relative humidity if they are to develop. It was shown also that the humidity at the base of the fleece of healthy sheep is surprisingly low, about 40-70 per cent. even under showery conditions. We can, then, picture the normal sheep as possessing a dry area in the wool near the skin, in which eggs and young maggots cannot develop. This dry region must be penetrated by moisture before there can be any attack by maggots. Dung and urine will cause penetration to the skin by moisture in the hind quarters. In other regions of the body some condition, such as the wool condition mentioned, is necessary before a high humidity can be maintained near the skin and so permit development of eggs or maggots.

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Any method, therefore, that maintains or promotes dry conditions near the skin will greatly assist in preventing an attack. The effect of different dips on the humidity in the fleece is being studied.

Dry conditions in the fleece may result from the physical nature of the wool that will permit rapid drying out. For example, the fact that the Wiltshire breed and its crosses are rarely attacked is probably due to the hairy nature of the fleece and the absence of any thick wool. Some farmers in this district buy in Wiltshire cross lambs in order to avoid trouble from this pest. It has also been noticed that certain types of Welsh sheep, which have a hairy region around the breech and under the tail, are less subject to attack.

In order to test the effect of the drying out of the fleece as a control for maggot attack, 35 lambs were shorn over the entire body and grazed with another 35 unshorn lambs at the College farm in 1934. During the period of observation the maggot attack was only slight, but it was interesting to note that all 4 cases of attack were on unshorn lambs and that not one of the shorn lambs was attacked, although instances of bad scouring were found among these lambs. It has been learnt that in parts of mid-Wales and in the Romney Marsh, it is the practice of some farmers to shear the lambs along with the ewes in the early summer solely to reduce blowfly attack.¹¹

2. COUNTERACTING ATTRACTION OF THE SHEEP FOR BLOWFLIES. The ideal method of control would be to prevent the sheep from attracting blowflies. With the knowledge gained on the nature of the attraction, it has now been possible to test systematically a wide range of chemicals as repellents to blowflies on sheep.

Various proprietary dips, used primarily for the control of sheep scab, were tested first to find out if any acted as repellents to the flies. The dips included arsenical, sulphur, carbolic, sulphur-arsenic, nicotine, derris, pyrethrum and spirits of tar. At varying periods after dipping, a small quantity of the standard attractant solution (2 per cent. ammonium carbonate) was placed on a piece of cotton wool which was tied in the fleece of the dipped sheep. With all the dips mentioned, flies arrived and laid eggs in a very few days after dipping, showing that there was no marked repellent effect by any of the dips. A search for an efficient repellent among other chemicals not used at present in dips

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has, therefore, been commenced. Since the wool condition referred to is known to attract blowflies, its nature and treatment are being studied.

3. **DESTRUCTION OF NEWLY-HATCHED MAGGOTS ON SHEEP.** The alternative method of control by destroying newly-hatched maggots before they cause damage is also being investigated. The value of the previously-mentioned dips as poisons and the duration of their toxicity in the fleece were tested by taking samples of the wool of dipped sheep at weekly intervals after dipping and feeding young maggots on serum added to this wool. Details of the experiments will be published elsewhere, but the results of these tests can be summarized as follows:—

Samples of wool from the sulphur, derris powder, pyrethrum dips were not toxic after 1 week; wool from carbolic-dipped sheep ceased to be toxic after 2 weeks; whereas the fleece of sheep dipped in arsenical dips remained toxic for 3-6 weeks. There is no doubt, therefore, that of the existing proprietary dips those containing arsenical compounds are the most efficient and that these act mainly as stomach poisons and not as repellents. There is evidence, however, that most of the arsenical dips, even when used at the half-strength for sheep scab dipping, do damage the skin, causing a special type of wool condition, and a search, therefore, is being made for a dip of equal larvicidal value, which is harmless to the skin.

DRESSINGS FOR MAGGOT ATTACK. There is a real need for an efficient dressing for maggots on sheep. The ideal dressing should destroy maggots quickly before they fall to the ground, should act as an antiseptic in healing the wound, and should prevent reblowing by flies.

The usual dressings in this country are carbolic solutions. Most of these are successful in killing the maggots, but they are particularly harmful to the skin and do not prevent reblowing. It has not yet been possible to make a systematic study of chemicals to find an efficient larvicide, but, owing to the number of attacks during 1936, an emergency dressing of paraffin was added to reduce the proportion of cresol in order to minimize the harmful effects of carbolic solutions. This was used with success as a dressing for most of the attacks in the experimental flock, but it is hoped in 1937 to prepare a more efficient larvicide that will have all the properties of an ideal dressing for maggot attacks.

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Recently,¹² the Australian workers recommended glyceroboric preparations as dressings for maggots. These were tried on the experimental flock in 1936, but, unfortunately they are expensive and in several instances did not succeed in destroying the maggots or preventing further attacks; they were efficient in cases of slight attack.

It is intended to develop the most promising lines of control as rapidly as possible during the season of attack, and a technique has been elaborated for continuing the study of certain aspects of the problem during the winter session. Since there is evidence that sheep maggot attack may vary somewhat among different breeds, the junior writer will always welcome any observations made by sheep owners whose flocks are subject to frequent attack.

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WHITEHEADS OR TAKE-ALL IN WHEAT

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IN recent years the disease of wheat known as Whiteheads, or Take-all, has been more prevalent than formerly, especially on some farms on the lighter soils of Norfolk, Hampshire, and the Yorkshire Wolds. The disease is mainly troublesome when several white-straw cereal crops are taken in succession on light land. With the tendency towards greater mechanization of farm work there is often a larger proportion of cereal crops on the farm at any one time than in former years, and under these conditions it becomes very difficult sometimes to keep the trouble under control. Knowledge of the disease has increased considerably during the past few years, and a brief account of what is now known about it should be of interest at the present time.

Empty ears in wheat may be the result of one or other of a number of different causes, including both fungus root-rots, and insects such as the Stem Sawfly and the Hessian Fly. It is considered by some workers that severe attacks of Whiteheads are often due to a complex of several of these troubles, since all tend to multiply if land is cropped too frequently with wheat. This may sometimes be true, but there is no doubt that the disease here discussed, namely, the root-rot due to the fungus *Ophiobolus graminis*, is the most serious and the commonest cause of Whiteheads on light soils, and is responsible for by far the greatest losses. On farms where it has been allowed to multiply, it may cause trouble not only when two or more crops of wheat are taken successively, but also on land that has been fallowed or under some other crop, which might therefore have been considered likely to be free from the disease.

Name of the Disease. Take-all was the very expressive name given to the disease by the farmers of Australia, who suffered severely from it in the latter half of last century. After the introduction of improved fallowing methods and the use of superphosphate, the disease became less serious there, but it is still an important factor to be considered on light, alkaline soils. The disease is known both in a severe, early form, in which the plants die before heading, and in a less

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severe, later form, in which the plants come into ear, but bleach off before ripening, and fail to produce grain. Originally, the former stage was known as Take-all and the latter as Whiteheads or "dead heads," but after MacAlpine proved in 1900 that the two forms were caused by one and the same fungus, the name Take-all has come to be the one generally used for all stages of the disease.

In England, the early stage, in which the plants die before heading, does not occur very frequently, and it is the bleaching of the ears just before harvest that is the more familiar form of the disease. Consequently, names such as "blight," "whiteheads," and "night ripening" have come to be those most generally used in England, the name Whiteheads being the one at present recommended in the List of Common Names of British Plant Diseases. Nevertheless, some English farmers who have experienced trouble with the disease recently, and who have read something of its occurrence overseas, have been employing the name Take-all as used in published accounts of the disease from Australia, Canada and the United States. Since frequent reference will be made here to the occurrence of the disease in these countries the name Take-all will be used in this article.

Symptoms. When infection is very severe, the plants may begin to look yellowish and stunted in spring, and may fail to come into ear. More commonly the crop comes into ear normally, and diseased plants become visible as a result of premature ripening, or rather, bleaching. The plants become almost white instead of the normal golden colour of ripe corn, and the ears are found to be empty, or to contain only shrivelled grains. In damp summers these whitened, dead ears usually become spotted with a greenish-black growth of moulds.

The old distinction between the Take-all and the Whiteheads stages of the disease has been somewhat over-emphasized in the past, since all intermediate stages between the two conditions are found. It is quite common, for instance, to find dead plants with the ears formed but still enclosed within the sheaths, and others in which the ears had only partially emerged at the time of death. The severity of the disease depends upon the extent to which the root system is destroyed by the fungus. If conditions greatly favour the fungus, the

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wheat plant dies before heading. If conditions favour the wheat, grain may mature in spite of the presence of some of the fungus on the roots. Usually, however, there is an intermediate state of affairs, and the wheat plant is able to grow to the stage of heading, the growth of the fungus on the roots being by that time so far advanced that death and bleaching of affected plants occurs shortly before the normal ripening of the crop.

It is usually not until this stage is reached that the farmer is able to see the extent of his losses. The prematurely whitened plants are then easily distinguishable scattered among the normal green plants. The most important confirming evidence that the disease is Take-all is the blackening of the roots and the base of the stem (Figs. 1 and 2). The blackening on the base of the stem can usually be seen better when the basal leaf-sheaths are pulled away (Fig. 1). There is often a thin black coating of fungus, called "plate mycelium," between the leaf-sheaths and the stem, which may be pushed off in fine flakes with the thumbnail.

If weather conditions have been dry, and the growth of the fungus slow, it sometimes happens that blackening may not be visible on the stem-base. It may still be possible, however, to find blackening on the roots, particularly if they are first washed in water. When the weather has been moist, the blackening on the base of the stem may become very pronounced. It is due to the mycelium of the fungus growing up from the roots. In advanced cases of the disease it is sometimes possible to see with the naked eye the spore-cases of the fungus, as small black bodies, embedded in the blackened portions of the leaf-sheaths.

Cause of the Disease. The fungus that causes the disease, *Ophiobolus graminis*, acts as a parasite on the roots of living cereals and grasses, and does not multiply in nature except on these hosts. Its life-history is briefly as follows: Infective material of the fungus, capable of attacking healthy plants, may be of two kinds: *a*, mycelium in pieces of root or straw left in the soil from a previous cereal or grass crop on which the fungus had developed, and *b*, spores that may have been carried some distance by wind and rain from spore-cases developed on infected stubble or on a wild grass in the neighbourhood. When either material, be it a fragment of infected straw or spores wind-borne from some distance away,

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comes in contact with the roots of a healthy wheat plant, other conditions being favourable, it causes infection. The fungus grows in a characteristic way as long, dark, runner hyphae down the outside of the roots, side-branches then penetrating towards the centre of the root and absorbing the food material. As far as is known, the mycelium of the fungus will not grow in soil alone, so that spread of the disease from plant to plant through the soil does not occur until the roots of neighbouring plants come into contact, when it grows from root to root. The rate of growth of the fungus along the roots depends very much on soil conditions, discussed in further detail below. Under favourable soil conditions, however, the fungus soon reaches the crown of the plant, whence it can spread to all the roots and seriously interfere with the nourishment of the developing wheat. Under moist conditions, the fungus grows up the base of the haulms forming the black "plate mycelium," previously mentioned, and finally produces minute spore-cases embedded in the leaf-sheaths (Figs. 1 and 2). Each spore-case (Fig. 3) contains some hundreds of spores, too small to be visible to the naked eye.

From this stage the life-cycle begins again. The infected roots and straw from the diseased crop may either be ploughed in, or be left for some months as stubble, perhaps sown with a seeds mixture. In both practices the infected material remains in the soil, a source of danger for some time to any further cereal or grass crop sown there. In the second, however, when the infected stubble is *not* ploughed in, there is an additional source of danger, namely, the development of further spore-cases on the diseased stem-bases as autumn advances, and the discharge of spores, which may be blown over healthy crops in the neighbourhood. These two sources of infection may now be considered in somewhat more detail.

Persistence of Mycelium in the Soil. Many of the worst outbreaks of Take-all come from ploughing up a stubble that may have been only slightly diseased, and then sowing another crop of wheat within the space of a few weeks. In such circumstances there is not time for infected material to rot away before the new roots of the young crop are growing down amongst it. Naturally, the roots become infected at an early stage, and if a warm, moist spring follows, the disease may develop rapidly and seriously damage the crop.

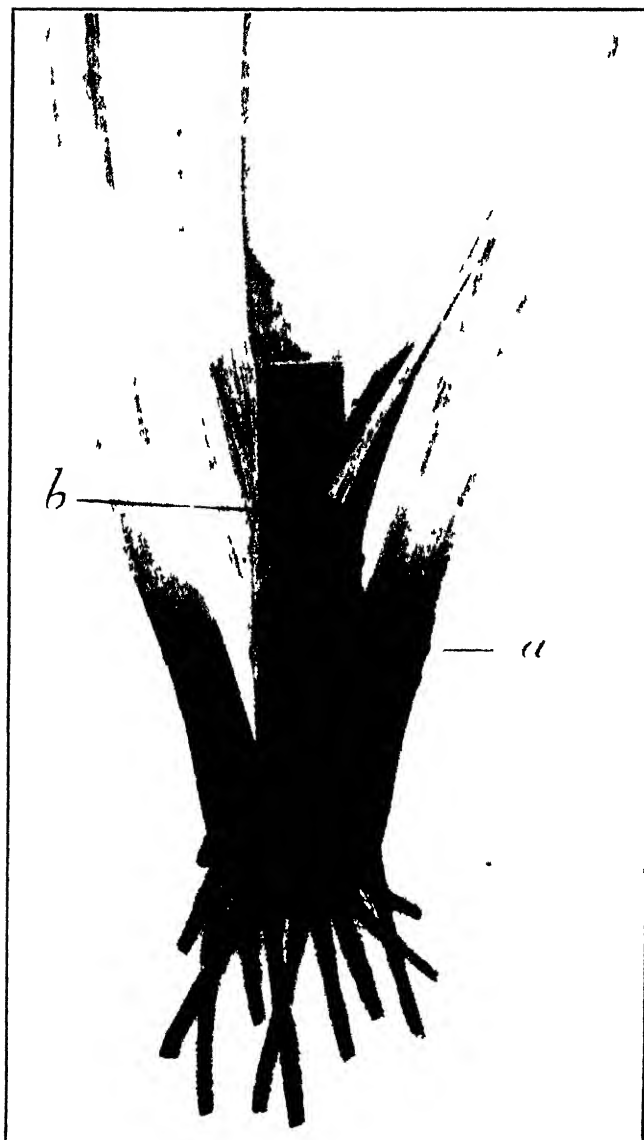


FIG. 1. Showing the blackening at the bases of the culms of a wheat plant affected with Whiteheads or Take-all. Late stage in which the necks of the spore cases of the fungus are visible as minute black points (a) in the blackened parts of the leaf sheaths. The leaf sheath has been pulled away to show the dark coloured flakes of plate mycelium (b) on the base of the stem itself.

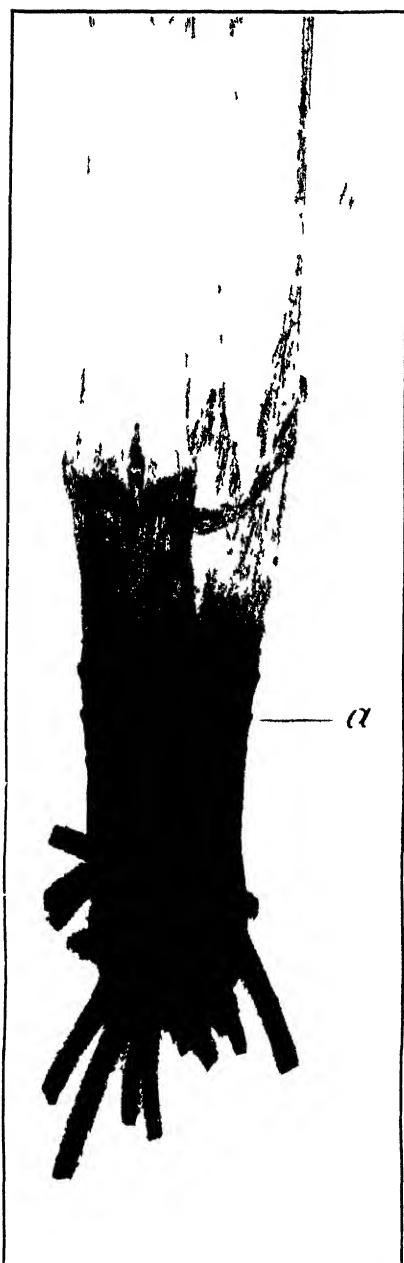


FIG. 2 Showing (as in Fig. 1) the blackening at the base of the haum, with the necks of the spore cases protruding, as at (a).

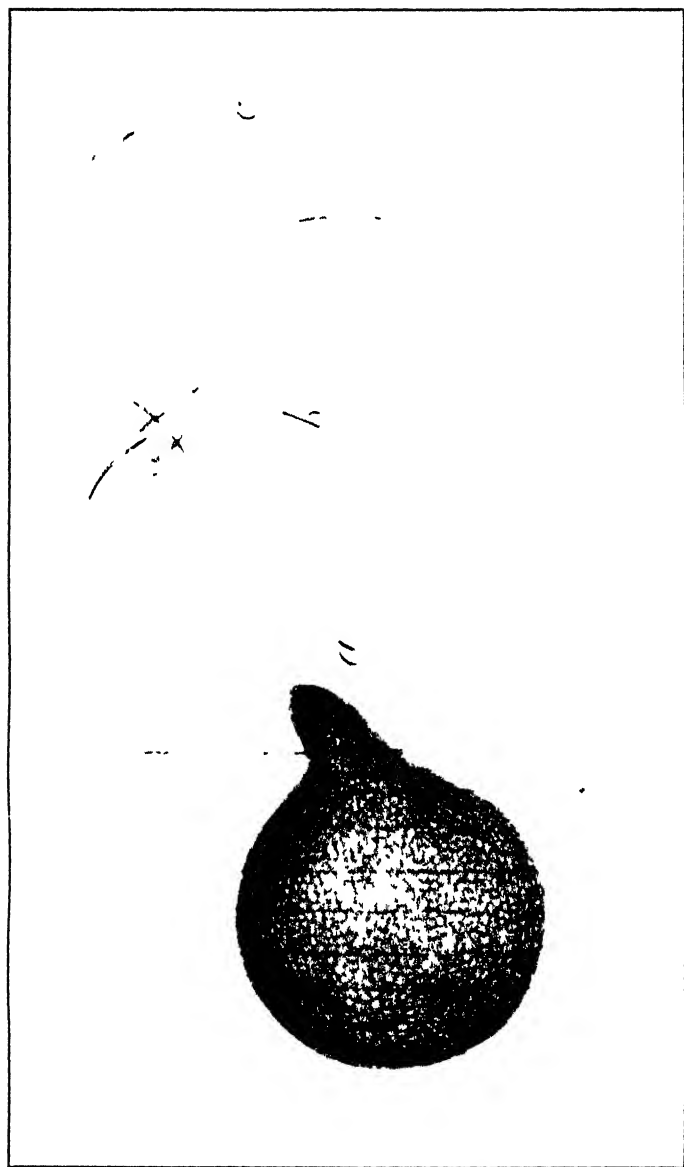


FIG. 3. A spore case of the lake fungus *Ophiobolus spumiger* embedded in a section of leaf sheath, with neck protruding much magnified. One packet of eight spores (a) is just emerging from the neck, another (b) has just burst in the air and a few spores (c) from the previous packet of eight are still floating in the air near it. The spores are too small to be visible to the naked eye.

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A similar result may follow the ploughing in of grass. The Take-all fungus is frequently present in grass fields, maintaining itself from year to year by slow growth in the mat of roots, the grass apparently healthy. If a grass field is ploughed up and sown to wheat after too short an interval, a serious attack of the disease may develop.

It is important, therefore, to know how long the fungus can remain viable in the soil in the absence of its host plants. In the past it has sometimes been recommended that, after an attack of the disease, land should not be sown with wheat for two or three years, or even longer. It is very doubtful whether such long periods are necessary. Unfortunately, in spite of the practical importance of the point, very little reliable information about the rate of disappearance of the Take-all fungus from different soils is available. There is no doubt that the rate of disappearance will vary in different circumstances. In soils of different acidity or alkalinity, different moisture content, and different organic matter content, it would not be expected that the fungus would always rot away at the same rate, but the question remains whether the period is likely to be one month, three months, six months, twelve months, or more. A systematic investigation of this point is now being carried out by Mr. S. D. Garrett at the Rothamsted Experimental Station, and it may, perhaps, be said at this stage that, under the moisture conditions prevailing in English soils, it is very unlikely that the fungus would last as long as a year, provided the stubble has been ploughed under.

The safest way to ensure that there shall be no danger of infection from mycelium in the soil is, of course, to adopt a rotation in which wheat or barley is not sown immediately following a previous cereal or grass crop. Soil can be freed from the Take-all fungus by means of fallows of several months' duration, or by the growth of non-cereal crops such as beans, sugar-beet, etc., provided these are kept clean from grass weeds. If it is specially desired to follow wheat with wheat, then the sooner the stubble of the first crop is ploughed in, and the longer the field is left before sowing the next crop, the less likely will be loss from the disease. In other words, wheat may be sown early on land that has been fallow for several months or has carried some non-cereal crop, but after a previous wheat crop, stubble should be ploughed in early and seed sown late. Wheat should never be sown following

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a previous wheat crop in which the Whiteheads or Take-all disease was known to be present.

The Australian practice of burning stubble helps greatly in reducing the amount of fungus present before fallowing begins. This is not often possible in England, however, because of the shortness of the stubble left by English reapers. Frequent working of the lighter soils, to stir them up, compact the lower layers and check the growth of weeds, has also been found in Australia to aid in more quickly eliminating the fungus.

Dissemination by Spores. The second source of infection, namely, wind-borne spores, may now be considered in more detail. This danger arises when a stubble infected with Take-all is not ploughed in, but is left untouched while the new season's crops are sown, or because a seeds mixture was sown with the wheat. In these circumstances the fungus is able to mature its spore-cases slowly on the old diseased stem-bases, and the spores ripen about October and November. When the spore-cases are wetted by rain after periods of slow drying, the spores are ejected into the air at the rate of up to several hundred per minute from a single diseased stem-base. When the rain ceases the spore-cases gradually dry, maturing further spores, and when later rains come, still more spores may be discharged from the same spore-cases.

Although these facts in the life-cycle are known, and it is known that ascospores can infect young wheat plants, it is unfortunate that practically no studies have been made on the field side of this problem. Since the spores are ejected only during or immediately after periods of rain, and since the rain would usually tend to carry them down from the air into the soil, it is unlikely that large numbers of spores would travel much more than a few hundred yards. A few might easily travel greater distances, but the numbers would be fewer and fewer the farther from the source of discharge. Most of the spores, however, would not succeed in reaching growing roots that they could infect. In light, sandy soils, it might be possible for them to be washed down into contact with roots, but the heavier the soil the less would this be likely to occur. Further studies on spore infection in different types of soil are therefore very desirable.

At present, it seems possible that if the prevailing winds carried spores over young cereal crops growing on light soils,

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there might well be many spores that would be washed down into the soil into contact with roots. Fortunately the delicate spores of the Take-all fungus have a very short life, probably about a week only, under the most favourable conditions,* so that unless they were actually carried over cereal or grass crops they would not be likely to be a source of danger.

It is possible that in some districts infected grasses in headlands or fields might be another source of spores, but if this is so, it is likely to be to a small extent only. This is another of the points upon which further information is needed for English conditions.

Determining the Source of Infection. When a wheat crop has been affected by Take-all, it is of interest to endeavour to determine the source of infection, as an aid to guarding against a future recurrence. From what has been said above it is evident that infection must have come from one of two sources—either it was in the soil when the crop was sown, remaining from a previous cereal or grass crop, or it was carried as spores over the growing crop at times of winter or spring rains. Very often a knowledge of what was in the field, and also in adjacent fields, the previous season, will be sufficient to decide the question of the source. There are, however, certain general characteristics of the two types of infection that may be of assistance in reaching a decision. As a rule, infection resulting from mycelium left in the soil tends to result in more or less definite patches of disease in the crop, as compared with the occurrence of individual plants showing Whiteheads scattered promiscuously among the healthy plants, which is likely to be more characteristic of spore infections. The former type of infection may also be more or less evenly distributed over the whole field, whereas the latter is usually more severe on one side—the side from which the spores came—gradually getting less and less across the field. There are so many modifying factors that may obscure these characteristics, however, particularly differences in soil conditions, that too much reliance should not be placed upon them.

The Influence of Soil Conditions on the Development of the Disease. It is well known from field experience that the development of the Take-all fungus is very much influenced by soil conditions. It is more to be feared on light than on

* See page 241.

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heavy soils; it is more serious on alkaline than on acid soils; and it is more serious on soils poor in organic matter than on those well supplied with this. Satisfactory scientific explanations for all these types of behaviour are not, as yet, known, but research work now being carried out is increasing our knowledge considerably. Workers in Canada and the United States have shown that the presence of organic matter exercises an inhibitory effect on the fungus, and they attribute this to the antagonistic effect of certain of the soil micro-organisms present. It seems possible that the periodic dressings of dung given to many English fields may have some beneficial effect in minimizing the amount of Take-all and other cereal root-rots. In Canada and Australia, wheat fields are not manured with dung. In England S. D. Garrett² has made a study of the effect of certain soil conditions, particularly soil reaction, on the development of the disease, and suggestions have been advanced to account for its greater prevalence on alkaline soils. Slowly but surely this work is increasing our understanding of the often apparently erratic field occurrence of the disease.

In the meantime, some lessons may perhaps be drawn from field experience of the disease in countries where it is prevalent. In Australia a loose seed-bed has been found to be favourable to it, and light soils are ploughed only 2 or 3 in. deep. Sometimes, rolling, or grazing off with sheep, is adopted with the object of compacting the soil. It will be noticed that in doing everything possible to consolidate light soils and discourage Take-all, these operations at the same time improve the soils for the growth of wheat, and this is undoubtedly partly the basis of their good effect.

Manuring. Manuring may also be of importance. The requirements of different soils are so varied that it is not possible to make statements that will apply for all. Since the disease is favoured by alkaline conditions, however, preference should be given to sulphate of ammonia as a nitrogenous manure rather than to the more alkaline nitrate of soda, or nitro-chalk, unless the soil is definitely acid in reaction. In Australia, superphosphate has a very beneficial effect, mainly because Australian soils are very deficient in phosphate; the supply of this substance promotes the production of a more vigorous root-system, thus favouring the

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wheat plant as opposed to the fungus. It may be said in general that liberal manuring, according to the requirements of the particular soil in question, will have a beneficial effect in minimizing the effect of the Take-all fungus if it is present.

Plants Attacked. A variety of wheat has not yet been found that is immune from this disease, but red wheats, as a class, are considered to be somewhat more resistant than white wheats. A reasonably good crop of Little Joss has been seen alongside a crop of a white wheat that was a total failure from Take-all. Under some circumstances, however, even red wheats such as Little Joss may be badly attacked. When tested by inoculation in the seedling stage, red wheats are found to be just as susceptible as white wheats, so that differences in resistance observed in the field depend perhaps upon differences in the amount of lignification or woodiness that develops in the roots with maturity, or some other such factor. Of the other commonly grown cereals, barley is fairly susceptible, and it is dangerous to grow wheat after barley, or barley after wheat if there has been any sign of Take-all in the first crop. Rye is considerably less susceptible, and oats still less so. In Australia, oats are considered to be practically immune, and they can be sown with safety following a diseased wheat crop. Under the wetter conditions in England, however, especially in the west, there have been a number of instances of oats having been affected by the disease.

Many grasses are susceptible, and Kirby⁸ has listed nearly 100 species that became diseased in greenhouse tests. Some species are so susceptible that affected plants bleach white in summer, have blackened stem-bases and develop spore-cases of the fungus, in a similar manner to wheat. On others, the fungus maintains itself in the mat of roots without causing appreciable harm to the grass, as was mentioned above. Some others appear to be immune. Fortunately, most of the rye-grasses (*Lolium* spp.) appear to be very resistant under field conditions. Practical advantage is taken of this on some farms in Australia. The prevalent wild grass in certain districts there is barley grass (*Hordeum murinum*), which is very susceptible to Take-all. In these districts it is always dangerous to plough up a grass field and sow to wheat after too short an interval. A little of the Australian rye-grass known as Wimmera Rye Grass is put in with the wheat.

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This seeds under the wheat crop and produces a fairly good rye-grass pasture on the stubble the following year, largely keeping out the worthless and dangerous barley-grass. Farms that have adopted this practice have often been freer from Take-all than their neighbours. In England, however, it would be much more difficult to suppress a susceptible grass, such as black bent (*Alopecurus agrestis*), in a similar way, owing to its perennial rhizomes. More knowledge about the susceptibility of English grasses is still required.

Influence of Weather. Finally, a few words should be said about the influence of weather, although unfortunately not nearly enough is known on this subject. In England, Take-all was more prevalent in 1935 than in 1936, and this must have been in some way connected with the weather. The suggestion has been made that the disease is worse after mild than after cold winters; and this seems reasonable, for the Take-all fungus is not able to grow so well under cold conditions as is the wheat plant.

Kirby,³ in America, considered that a warm, wet spring favoured Take-all, while Russell,⁴ in Canada, and Garrett,¹ in Australia, also considered that a wet spring favoured the disease. There is no doubt that the disease is worse under wet conditions. There are, however, several distinct questions involved that are apt to be confused because they overlap to some extent. One is the effect of weather on the dispersal of spores of the fungus; another is its effect on the survival of mycelium in the soil; while still another is its effect on the course and severity of the disease in plants already infected. A proper understanding of the climatic factor will not be obtained until each of these questions has been studied separately.

Recommendations for Control. From the above it will be evident that the measure of primary importance in the control of Take-all is the elimination of the two sources of infection, namely, the mycelium left in the soil from a previous cereal or grass crop, and the spores developing on diseased stubble. If the disease has appeared in a crop, the following measures for future control should therefore be adopted:

(1) Ploughing in the stubble as early as possible. This prevents it from being a source of infection to neighbouring

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crops by means of wind-blown spores, and it also starts the process of decomposition of the fungus in the soil.

(2) Rotation of crops. Wheat should preferably be followed by some non-cereal crop, such as sugar-beet, mustard, flax, turnips, beans, clover, etc. The Take-all fungus soon disappears from the soil under these crops, provided grasses are not allowed to grow in them. If it is desired to sow a grass with clover, rye-grass is probably the best to use; other grasses may favour the fungus.

If it is particularly desired to grow a cereal crop again, oats is the safest, although this may also be affected under wet conditions. It is too dangerous to grow a further crop of wheat following one that has had the disease. When considering whether another crop of wheat or barley could be taken following a crop in which practically no disease could be seen, it should be remembered that the practice of early ploughing of the stubble, and late sowing of the following cereal crop, gives a longer period for decomposition of any slight amount of disease there may have been, and thus provides the safest conditions. The growing of successive crops of wheat or barley on light land must always be dangerous, however. Of the wheats, red wheats are safer than white wheats.

(3) Manuring. On alkaline soils sulphate of ammonia should be used as a source of nitrogen in place of nitrate of soda or nitro-chalk, while superphosphate should be used liberally if required by the soil.

(4) On light soils fallows should be kept well worked to destroy grasses and to make a firm seed-bed.

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A POISON BAIT FOR SLUGS

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IN the course of the past year, several letters have appeared in the horticultural Press* stating that good results have been obtained by the use of a new type of poison bait for destroying slugs and snails. This consists of a mixture of bran and "Meta," a solid fuel sold for heating small domestic appliances and for similar purposes. It is known that the chief constituent of "Meta" fuel is the compound metaldehyde,† a polymerized form of acetaldehyde.

Slugs and snails are among the most troublesome pests on farms and in gardens and greenhouses alike; they are notoriously difficult to control, and though a poison bait containing the arsenical compound, Paris green, has long been recommended, and in many instances has given good results, it has obvious disadvantages. It has therefore seemed desirable to give a brief account of some preliminary trials with bran baits containing "Meta" and metaldehyde, in order to draw attention to the possibilities of the method.

The bait is prepared in the same manner as a Paris green bait. Sufficient water is added to the bran to make it moist without causing the flakes to stick together, the powdered "Meta" or metaldehyde is added, and the whole very thoroughly mixed. The mixture may be made up dry, if preferred, and can be used without addition of water if the ground is moist. Various proportions have been tried. "Meta" is sold in the form of small sticks, each weighing about 4 grm., and a convenient amount to use on a small scale is one stick (4 grm.) to about 1 quart of bran. The "Meta" is easily ground to a fine powder: metaldehyde is obtainable as a fine crystalline powder. The bait may be broadcast, but

* *Gardening Illustrated*, May 2, 1936, and *Gardeners' Chronicle*, Dec. 19, 1936, Jan. 23 and 30, 1937.

† *Thorpe's Dictionary of Applied Chemistry*, Supplement Vol. 1, 1934, p. 7.

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is perhaps most effective if placed in little heaps about 1 ft. apart.

The notes that follow give details of some trials with these baits. Counts were made of the numbers of slugs poisoned, but it should be emphasized that no particular significance can be attached to the comparative figures, since information was not available as to the total population of slugs in the area on which the baits were placed, nor is anything known as to the distance from which slugs may be attracted. It is probable that the variations in the numbers are due rather to differences in the slug populations than to real differences in the efficacy of the baits. The initial action of the poison seems to be rapid, but affected slugs may remain alive in an apparently moribund condition for some time.

I. HARPENDEN. On plots of swedes and young wheat in garden.

1. "Meta" : 4 grm. to $1\frac{1}{2}$ pints of bran.
2. Metaldehyde : 4 grm. to $1\frac{1}{2}$ pints of bran.

Small heaps placed at intervals of about 12 in. between alternate rows of swedes and wheat on the evening of January 12.

SLUGS COLLECTED							
Wheat Plot				Swede Plot			
	"Meta"		Metaldehyde		"Meta"		Metaldehyde
Jan 13 ..	17	..	29	..	25	..	51
Jan. 14 ..	12	..	14	..	11	..	15
	--		--		--		--
	29	..	43	..	36	..	66
	--		--				--

A few more were found on subsequent dates.

Slugs were not very numerous on these plots and little noticeable damage had been done to the plants. Only two species were represented, 64 per cent. of the total number being *Agriolimax agrestis* (Grey Field Slug) and 36 per cent. *Arion hortensis* (Garden Slug).

II. HARPENDEN. Swede plot in garden.

Small heaps placed as in I. on the evening of January 25; there was a slight frost at night.

		Slugs Collected	
		Jan. 26	
Row 1.	Metaldehyde : 4 grm. to $1\frac{1}{2}$ pints of bran ..	..	28
Row 2.	" " " " " " " " ..	..	13

III. BOURNVILLE. Private garden.

Four small heaps of the two mixtures given below were

A POISON BAIT FOR SLUGS

placed out and covered with tiles on the afternoon of February 4.

				Slugs Collected	
				Feb. 5	
1. "Meta"	4 grm. to 2 pints of bran	..	..	..	253
2. Metaldehyde :	3 " " " "	..	..	..	149

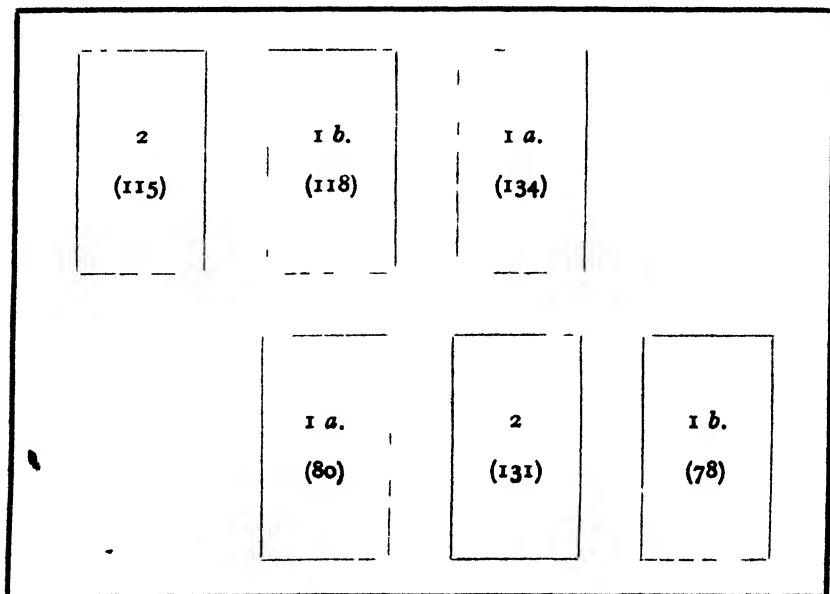
The difference in the figures was largely accounted for by about 60 more slugs round one of the "Meta" heaps. The majority of the slugs here were *Milax* sp. (Keeled Slug), the figures being *Milax* sp. 79 per cent., *Arion hortensis* 20 per cent., and *Agriolimax agrestis* 1 per cent.

The following night there was frost and no slugs were seen, but observations were continued by Mr. Wakeman, the owner of the garden, to whom the writers are much indebted, and by Feb. 22 totals of approximately 850 had been counted on Plot I and approximately 550 on Plot 2. Slugs continued to be caught on these heaps up to the time these notes were written (March 21).

IV. HARPER ADAMS AGRICULTURAL COLLEGE GARDEN. On plot of cabbage damaged by slugs.

1a. " Meta "	..	..	4 grm. to 2 pints of bran.
1b. " "	..	..	8 " " " "
2. Metaldehyde	4 " " " "

The baits were put out on the night of February 4, arranged as below.



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The area concerned was about 45 sq. yards, and each lot of bran-bait was scattered over about 1 sq. yard with a small covered heap in the centre. The figures in brackets show the numbers of poisoned slugs counted on each area on the following morning. They were mostly near the edges of the patches and very few were at the central heaps. The following night was frosty and no slugs were found, but the central covered heaps remained attractive and many more slugs were caught on each of the few warm nights that occurred during the following 6 weeks. Owing to the very wet condition of the ground, these were not regularly counted, but about 150 were collected at about the middle of this period, and there were many on the heaps on March 21. No significant differences in the numbers were noted on the different areas. Here 80 per cent. of the slugs collected were *Milax* sp., and 20 per cent. *Arion hortensis*.

Subsequent further trials on these lines were unsuccessful owing to low temperatures and flooding.

The figures quoted may serve to show the kind of results obtainable with these baits in the winter and under unfavourable weather conditions. The chief catches were made on comparatively warm nights, and many instances are known to the writers where evidently much larger numbers (not counted) have been poisoned in private gardens during the warmer weather in the autumn, when slugs were more abundant and active.

In a large-scale field experiment in April, over more than an acre, on which the "Meta"-bran bait was broadcast in the manner recommended for Paris Green bait, counts on 64 separate sq. ft. areas across the middle of the field gave an estimated "kill" of slugs of some 50,000 per acre, and of some 70,000 per acre from counts on 44 sq. ft. areas nearer the hedges. Similar figures were obtained on another smaller-scale field trial.

The bait seems to be attractive to all the common and destructive species of slugs, and snails also are reported to take it readily. No evidence has, however, been obtained that other soil pests are affected. In a recent experiment, for example, "Meta"-bran bait was compared with Paris Green and bran on a field of wheat infested with leather jackets: on the area treated with Paris Green bait, numbers of dead leather jackets were found (a rough count indicated a figure in the neighbourhood of 100,000 per acre), whereas, on the

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area to which the "Meta" bait was applied, the kill was negligible.

As will be seen from some of the figures given, the bait remains attractive to slugs for a considerable time if protected from heavy rain, and it is worth while arranging some simple form of covering. As far as the writers' observations go, wild birds do not eat it, though on one occasion poultry did so, without harm resulting. "Meta" and metaldehyde are, however, dangerous to the health of human beings if eaten, and it is essential to take all reasonable precautions in preparing the bait and using it.

It has already been mentioned that no special significance can be attached to the figures given above for the numbers of slugs killed under different conditions, and they cannot be taken as indicating any real differences between the efficiency of the various strengths used. More detailed experiments on these points are required, and it is hoped that they will be undertaken; the object of the present note is merely to draw attention to this bait as a possible means of reducing the numbers of slugs. In the meantime, it is suggested that those who wish to try the method should make up the bait in the proportion of 4 grm. of the poison (one stick of "Meta") to 2 pints (about 8 oz.) of bran. Judging by the results of the trials it is probable that pure metaldehyde and "Meta" are about equally efficient, but the former is at present considerably more expensive than "Meta".

Inquiries have been made as to the origin of the discovery that metaldehyde is attractive and poisonous to slugs and snails, since it seems likely to be of considerable importance. As far as can be ascertained, the suggestion came from South Africa, but the person to whom it was due has not at present been traced.

THE NUTRITIVE VALUE OF MEADOW HAY

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THE stock farmer rightly considers the hay crop to be one of the most important on the farm, and, given a good yield gathered under favourable weather conditions, he faces the winter months with a comfortable feeling that the greater part of the winter food of the stock has been safely put by.

Unfortunately, the hay crop is extremely variable as regards feeding value, and too few farmers take the trouble to obtain some analysis of the material so as to be able to feed it in the most economical way. In "Rations for Livestock"^{1*}, meadow hays are classified as *poor*, *good* and *very good*, and we have felt that a farmer often calls his average hay a *good* sample in rather an optimistic way. The chief discrepancy is to be found in the protein content, and the low value for this constituent in average hay is a shortcoming that is not often realized. Knox and Prowse², at Wye, examined a large number of hay samples, and it is of interest to reproduce two extracts from their paper, the first of which they give in italics:—

"It has become increasingly apparent that this assignation of samples of hay to arbitrary standards, having only one analytical interpretation, is not entirely satisfactory."

"An important feature of the results (of their series of analyses of samples of hay) is the generally low protein content. Of the thirty-one samples, only five had a protein content approximating that given for 'good' meadow hay in the published figures (9.7 per cent.)."

The average crude protein content of the samples was 8.18 per cent. and the fibre was 28.27 per cent.

We have also noticed this as a result of our examination of a large number of samples, and in an earlier publication³ reference was made to a series of samples of hay that gave crude protein contents varying from 6.54 to 8.31 per cent. of the dry matter. These were all made under carefully-controlled conditions in good weather from grass in full flower, in mid-June, the stage at which hay is most frequently cut.

* References are given on p. 260.

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To clinch the question, various samples of hay were collected from as many counties as possible during the winter of 1935. They were to be selected as typical of average hay made in that district in 1935, and a questionnaire was issued to obtain the farmer's opinion of the hay and particulars of the crop, its stage of maturity and the weather conditions during hay-making. These have been summarized in Table 1 for the twenty-two samples collected, all of which were harvested during the period from late June to mid-July, varying with the district. In eleven instances the dates of cutting and carting were given accurately, and the average time the hay was "out" was 7 days, with a range of 3 to 15 days. In only two instances was rain reported during the haymaking period, and the weather conditions were, generally speaking, favourable for haymaking. Several of the farmers cut the grass when it was in full flower, at a stage variously called by the farmers mature, ripe, or fully ripe. Seven were cut at this stage, five earlier than this at the early flowering stage, and five were over-ripe. Of the remaining five, the two from Lancashire were specially selected for us by Mr. R. Stewart, Advisory Chemist, Manchester University, as typical of average and good hays for the district.

The samples were obtained from fifteen counties, and, with two exceptions, they were made from permanent grass land.

The farmers' opinions are interesting. Out of 21 samples, five were described as *very good*, nine as *good*, four as *fairly good*, one as *average*, and two as *fair*—i.e., in the farmers' opinion, the average quality of the twenty-two samples was *good*.

Chemical Composition. The chemical composition of the hays is given in Table 2. There is no correlation between the stage of growth of the crop when cut and any particular constituent, but this is not very surprising. Of the four hays described as over-ripe or over-grown, numbers 7, 9, 13 and 16, two had crude protein contents above the average, and one had a crude fibre content below the average.

The fat or ether extract contents vary from 1.09 to 2.22 per cent., and, in general, a high fat content is associated with a low crude fibre content and *vice versa*.

The crude fibre contents vary between 30 and 36 per cent. with the exception of hay No. 10, which contained about 41 per cent. of this constituent.

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TABLE I

PARTICULARS OF HAY SAMPLES COLLECTED IN 1935

No.	County	Type of Herbage	Condition of crop when cut	Weather during making	Farmers' opinion of sample
1	Cornwall	Permanent, Rye Grass, Yorkshire Fog	Fairly mature	Slow but dry	Good.
2	Devon ..	First year's seeds, Rye Grass and clover	Mature	Good	Good.
3	Devon ..	Permanent	Fully ripe	No rain	Very good.
4	Berks ..	Permanent, Rye Grass, Cocksfoot	Fairly mature	Fairly good	Fairly good.
5	Bucks ..	Permanent	Fully mature	Good	Fair.
6	Oxford ..	Permanent	—	—	Good.
7	Monmouth	Permanent	Over-ripe	Fine and hot	Good.
8	Hereford	Permanent, mostly Fescue	Ripe	One shower of rain	Good.
9	Pembroke	Permanent, Cocksfoot, Timothy, Yorkshire Fog	Over-ripe	Two showers of rain	Good.
10	Warwick	Permanent	Standing well	Good	Very good.
11	Shropshire	Permanent	—	—	Fair.
12	Shropshire	Permanent	—	Good	—
13	Shropshire	Temporary, Rye Grass, Clover, Giant Cow Grass	Slightly over-ripe	Excellent	Fairly good.
14	Lanes ..	—	—	—	Average.
15	Lancs ..	—	—	—	Good.
16	Yorks . .	Permanent, Cocksfoot and Rye Grass	Rather over-grown	Good	Fairly good.
17	Yorks ..	Permanent	Fairly early condition	Good	Very good.
18	Yorks ..	Permanent	Nearly ripe	Good	Very good.
19	Yorks ..	Permanent	Ripe	Good	Very good.
20	Argyll ..	Permanent	Very good	Good	Good.
21	Perth ..	Permanent, Timothy	After flowering	Fairly good	Fairly good.
22	Kirkcudbright	Permanent, Cocksfoot, Fescue	Just ripe	Generally good	Good.

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TABLE II
CHEMICAL COMPOSITION OF HAY SAMPLES
(Stated as percentages of the Dry Matter)

No.	1	2	3	4	5	6	7	8	9	10	11	Average
Ether extract ..	1.55	1.38	1.77	1.59	1.80	1.77	1.86	1.96	1.99	1.16	2.10	See column below.
Crude fibre ..	34.54	35.57	32.77	32.38	35.57	36.25	34.47	30.06	31.25	40.96	30.82	
Crude protein ..	10.14	11.69	10.49	5.92	8.52	8.49	8.19	9.76	8.95	5.59	10.76	
Ash ..	7.02	10.00	7.47	7.28	7.56	7.18	6.94	8.21	7.39	5.51	7.76	
N-free extractives	46.75	41.36	47.50	52.83	46.55	46.31	48.54	49.81	50.42	46.78	48.56	
Organic matter	92.98	90.00	92.53	92.72	92.44	92.82	93.06	91.79	92.61	94.49	92.24	
True protein ..	8.22	10.60	8.95	5.52	7.68	7.40	7.37	8.20	7.71	5.14	9.42	
Dry matter in original material	81.80	83.80	84.30	85.70	84.00	83.80	85.80	85.50	86.30	84.70	83.60	

No.	12	13	14	15	16	17	18	19	20	21	22	Average
Ether extract ..	1.75	1.09	2.09	2.22	1.78	1.64	1.85	2.18	1.76	1.65	1.64	1.75
Crude fibre ..	34.03	34.61	33.91	31.13	35.46	34.32	31.40	30.98	34.71	35.64	34.34	33.78
Crude protein ..	9.17	4.81	9.96	12.90	9.07	7.51	7.82	9.07	10.26	6.40	10.79	8.92
Ash ..	8.38	5.62	7.22	8.68	8.28	8.57	8.36	7.59	8.49	6.75	6.48	7.58
N-free extractives	48.67	53.87	46.82	45.07	45.41	47.96	50.57	50.18	44.78	49.56	46.75	47.96
Organic matter	91.62	94.38	91.78	91.32	91.72	91.43	91.64	92.41	91.51	93.25	93.52	92.42
True protein ..	8.04	4.38	8.76	11.06	7.83	6.37	6.98	8.35	9.61	5.88	9.96	7.91
Dry matter in original material	83.80	83.80	84.80	82.80	85.10	84.30	84.80	89.90	80.40	80.80	84.60	84.30

There is a wide variation in the crude and true protein contents—the ranges being 4.81 to 12.90 per cent. and 4.38 to 11.06 per cent. respectively. The hays Nos. 4, 10 and 13 gave crude protein contents below 6 per cent.

It is generally accepted that an inverse correlation exists between the crude protein and fibre contents of fresh herbage, and, to a less extent, hays, but this is not evident in the present series of analyses. The hays examined, however, were, with few exceptions, low in crude protein, and it is probable that had some of the hays been cut earlier with a higher protein content, the correlation would have held good.

Smaller differences are seen in the ash contents, but hays Nos. 10 and 13 are again noticeable in their low content of this constituent. The N-free extractives or soluble carbohydrates, being calculated values, naturally show differences depending on the amounts of the other constituents present. The values vary from 41.36 to 53.87 per cent. The values for the dry

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matter contents of the hays do not present a true idea of the material leaving the stack, since changes would have occurred during the periods of transit to Jealott's Hill.

A comparison of the average compositions of the hays with those published in "Rations for Livestock" is given in Table 3, all the values being based on a moisture content of 15 per cent.

TABLE III
CHEMICAL COMPOSITION OF HAYS AS COMPARED WITH
STANDARD VALUES
(Stated as percentage of hay containing 15 per cent. moisture)
As published in
"Rations for Livestock"

	<i>Present Investigation</i>	<i>Poor</i>	<i>Good</i>	<i>Very Good</i>
Ether extract	1.49	1.49	2.48	3.04
Crude fibre	28.71	33.23	26.08	19.53
Crude protein	7.58	7.43	9.62	13.66
Ash	6.44	4.96	6.15	7.79
N-free extractives ..	40.78	37.89	40.67	40.98

According to these figures, if the crude protein content is used as a basis for comparison, the average quality of the hay would be *poor*. The low fibre content and high content of ash and N-free extractives, however, suggest that the value should be intermediate between *poor* and *good*. From the composition data, therefore, it would seem that the farmers had slightly over-estimated the values of the hays.

Digestibility. The digestibility of the hays was determined by using sheep as the experimental animals, and the digestibility coefficients are given in Table 4.

Some wide variations are seen in the digestibility coefficients of the ether extract or fat, the range being from 27 to 59 per cent. In the fibre, the values fluctuate less, and whilst the values are fairly high, there appears to be no inverse correlation between the crude fibre content and the digestibility coefficients, as might have been expected. For example, the digestibility of the fibre of hay No. 10, which from the chemical analysis would have been classed as a very mature hay owing to its high fibre content of nearly 41 per cent., is slightly higher than that of hays Nos. 18 and 19, which have low fibre contents.

The digestibility coefficients of the crude protein show some striking differences. The extremely low figure of 3.7 per cent. digestibility is given by hay No. 13, which contained only 4.8 per cent. of crude protein. Also hay No. 10, containing only 5.59

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TABLE IV
DIGESTIBILITY COEFFICIENTS OF HAY SAMPLES

No.	1	2	3	4	5	6	7	8	9	10	11	Average
Ether extract ..	50.00	27.89	51.40	56.90	37.93	48.98	44.45	44.37	50.64	46.59	52.30	See column below.
Fibre	61.09	61.29	64.47	67.60	54.27	62.67	55.82	61.87	66.41	60.99	64.73	
Crude protein ..	41.30	50.11	49.92	37.20	38.39	41.62	38.13	48.86	51.80	7.98	51.46	
True protein ..	38.18	49.88	47.70	31.70	34.69	35.99	34.80	42.54	47.91	11.22	49.29	
N-free extractives	55.30	52.90	59.12	68.20	59.90	57.86	51.76	63.89	65.95	57.12	63.65	
Organic matter	55.87	55.47	59.85	65.50	55.31	58.09	51.92	61.20	64.41	55.75	62.33	
Dry matter ..	54.79	54.32	58.63	63.30	53.40	56.10	50.88	59.83	62.62	54.01	61.35	

No.	12	13	14	15	16	17	18	19	20	21	22	Average
Ether extract ..	53.78	53.33	51.88	59.39	54.41	50.40	48.23	44.89	53.12	41.67	40.80	48.43
Fibre	64.97	63.41	64.10	65.65	68.90	63.03	59.84	59.59	61.04	62.60	59.86	62.46
Crude protein	54.09	3.75	48.82	57.65	49.78	40.18	42.04	37.61	50.54	30.65	53.72	42.07
True protein ..	50.74	3.03	49.33	56.92	50.17	37.81	38.65	36.84	49.43	29.24	54.62	40.03
N-free extractives	64.24	65.29	57.51	59.87	62.75	60.47	61.65	61.58	53.98	59.36	54.13	59.84
Organic matter	63.29	61.35	58.86	61.51	63.67	59.58	59.09	58.17	56.30	58.30	55.95	59.17
Dry matter ..	61.86	59.30	57.11	59.66	61.87	57.42	57.36	55.28	55.45	56.59	55.15	57.56

per cent. crude protein, gave a value of about 8 per cent. The remaining values varied between 30.6 and 57.6 per cent., and there is a distinct tendency for the digestibility to increase with increase of the crude protein content. The digestibility of the true protein follows closely that of the crude protein.

The digestibility coefficients of the N-free extractives, organic matter and dry matter show minor fluctuations, and generally speaking, the values are somewhat lower than those given by the fibre.

Digestible Nutrients. The digestible nutrient contents of the hays, calculated from the data in Tables 2 and 4, are given in Table 5. Those of the various hays show some rather wide differences, and the greatest fluctuations are seen in the contents of digestible true protein.

The nutritive value of the hays is judged on their starch and protein equivalent contents, and here considerable variations are to be seen. No relationship seems to exist between these two series of values, and in some samples high starch equivalent contents are accompanied by high protein equivalent contents, whilst in others the reverse holds. No

THE NUTRITIVE VALUE OF MEADOW HAY

TABLE V
DIGESTIBLE NUTRIENT CONTENTS OF HAY SAMPLES

No.	1	2	3	4	5	6	7	8	9	10	11	Average
ON DRY MATTER BASIS												
Ether extract ..	0.78	0.38	0.91	0.90	0.68	0.87	0.83	0.87	1.01	0.54	1.10	
Fibre	21.10	21.80	21.13	21.89	19.30	22.72	19.24	18.60	20.75	24.98	19.95	
Crude protein ..	4.19	5.86	5.24	2.20	3.27	3.53	3.12	4.77	4.64	0.45	5.54	
True protein ..	3.14	5.29	4.27	1.75	2.66	2.66	2.56	3.49	3.69	0.58	4.64	
N-free extractives	25.85	21.88	28.08	36.03	27.88	26.79	25.12	31.82	33.25	26.72	30.91	
Organic matter	51.95	49.92	55.38	60.73	51.13	53.92	48.32	56.05	59.65	52.68	57.49	
Starch equivalent	31.36	28.75	35.95	42.50	30.40	32.64	28.37	38.00	41.30	29.50	39.40	
Protein equivalent	3.67	5.58	4.76	1.98	2.97	3.10	2.84	4.13	4.16	0.52	5.09	
ON FRESH HAY BASIS (ASSUMING 15% MOISTURE)												
Starch equivalent	26.70	24.40	30.60	36.10	25.80	27.70	24.10	32.30	35.16	25.10	33.50	
Protein equivalent	3.12	4.74	4.05	1.68	2.52	2.64	2.41	3.51	3.54	0.44	4.53	

See column below.

No.	12	13	14	15	16	17	18	19	20	21	22	Average
ON DRY MATTER BASIS												
Ether extract ..	0.94	0.58	1.08	1.32	0.97	0.83	0.89	0.98	0.97	0.69	0.67	0.85
Fibre	20.81	21.95	21.74	20.44	24.43	21.63	18.79	18.46	21.19	22.31	20.56	21.08
Crude protein ..	4.96	0.18	4.86	7.44	4.52	3.02	3.29	3.41	5.19	1.96	5.80	3.97
True protein ..	4.08	0.13	4.32	6.30	3.93	2.60	2.70	3.08	4.76	1.72	5.44	3.35
N-free extractives	31.27	35.17	26.93	26.98	28.49	29.00	31.18	30.90	24.17	29.42	25.31	28.78
Organic matter	57.99	57.90	54.61	56.17	58.40	54.47	54.15	53.75	51.52	54.36	52.32	54.68
Starch equivalent	39.13	38.28	35.12	37.80	37.90	34.80	36.00	36.17	31.60	34.00	32.34	35.10
Protein equivalent	4.52	0.16	4.59	6.87	4.23	2.81	3.00	3.25	4.98	1.84	5.62	3.66
ON FRESH HAY BASIS (ASSUMING 15% MOISTURE)												
Starch equivalent	33.30	32.50	29.90	32.1	32.20	29.60	30.60	30.70	26.90	28.90	27.50	29.80
Protein equivalent	3.84	0.14	3.90	5.84	3.60	2.39	2.55	2.76	4.23	1.56	4.78	3.12

correlation can be found between the starch equivalent values and the state of the crop. For example, the two hays giving the highest starch equivalent values were described as "fairly mature" and "over-ripe", whilst the two hays giving the lowest values were described as "mature" and "over-ripe".

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The starch equivalent values have been calculated according to Kellner's⁴ method, and a deduction of 0.58 starch equivalent has been made for each per cent. of crude fibre, in preference to the use of a "value number". In "Rations for Livestock" it is considered that the starch equivalents of hays calculated by this method are too low, and in the published Tables the values have been increased by one-fifth. This has been done with the average value for the hay examined here, and the value is given in Table 6, together with the digestible nutrient content of the hay and the figures quoted in "Rations for Livestock" and Kellner's "Scientific Feeding of Animals."

TABLE VI
DIGESTIBLE NUTRIENT CONTENT OF HAYS
(Stated as percentage of hay containing 15 per cent. moisture)

	Hay— Present Investigation	" Rations for Livestock "		" Kellner "		
		Poor Hay	Good Hay	Poor Hay	Good Hay	Very Good Hay
Digestible ether extract ..	0.7	0.5	1.0	0.5	1.0	1.3
Digestible crude protein	3.4	3.4	5.4	3.4	5.4	7.4
Digestible true protein	2.8	2.5	3.8	2.5	3.8	5.0
Digestible fibre	17.9	15.5	14.9	15.5	14.9	13.8
Digestible N-free extractives	24.5	19.1	25.5	19.1	25.5	27.9
Starch equivalent	35.8*	21.8*	36.7*	18.9	31.0	36.2
Protein equivalent	3.1	2.9	4.6	3.0	4.6	6.2

* Starch equivalents, as calculated by Kellner's method, increased by one-fifth.

The figures given for the digestible nutrients in "Rations for Livestock" are the same as those quoted by Kellner, and it is only in the starch equivalent values that differences are seen.

Under the conditions obtaining in 1935, the average quality of the twenty-two samples of hay was good when the starch equivalent content alone is considered, but the protein equivalent content is about the same as the *poor* quality hay. It was expected that the hay would be above average quality, but it apparently was not if the description *good* is synonymous with *average*.

The results are disappointingly low, since owing to the generally favourable weather conditions, the losses of digestible nutrients during drying in the field were probably relatively small.

If the investigation had been continued in a year, such as 1936, when the weather conditions were inclement, the nutritive value of the hays would undoubtedly have been still lower.

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Considering the starch equivalent contents of the individual hays, eight lie about half-way between the *poor* and *good* class, twelve are in the *good* class and two could be called *very good*.

On the protein equivalent contents, eleven hays are *poor* (four of these might be classed as *very poor*), six lie intermediate between *poor* and *good*, and only five are *good*.

It is of interest to compare the farmers' estimates of the values of their hays with those of the approximate averages of the values based on the starch and protein equivalent contents. This has been done in Table 7, for 21 estimates, and the rough approximations show that only one farmer under-estimated the value of his hay, nine over-estimated and eleven gave fairly correct judgments.

TABLE VII.
QUALITY OF THE INDIVIDUAL HAYS

No.	Farmers' Estimate	QUALITY BASED ON		Remarks
		Starch Equivalent	Protein Equivalent	
1	G.	F.G.	P.	Over-estimated.
2	G.	F.G.	G.	Correct estimate.
3	V.G.	G.	F.G.	Over-estimated.
4	F.G.	V.G.	V.P.	Correct estimate.
5	F.	F.G.	P.	" "
6	G.	F.G.	P.	Over-estimated.
7	G.	F.G.	P.	" "
8	G.	G.	F.G.	Correct estimate.
9	G.	V.G.	F.G.	" "
10	V.G.	F.G.	V.P.	Over-estimated.
11	F.	G.	G.	Under-estimated.
13	F.G.	G.	V.P.	Correct estimate.
14	A.	G.	F.G.	" "
15	G.	G.	G.	" "
16	F.G.	G.	F.G.	" "
17	V.G.	G.	P.	Over-estimated.
18	V.G.	G.	P.	" "
19	V.G.	G.	P.	" "
20	G.	F.G.	G.	Correct estimate.
21	F.G.	G.	V.P.	Over-estimated.
22	G.	F.G.	G.	Correct estimate.

V.P. = Very poor. P. = Poor. F. = Fair. F.G. = Fairly good.
A. = Average. G. = Good. V.G. = Very good.

It is evident that the farmers' opinion can be misleading, and that some more accurate estimate of the nutritive value

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of the hay should be made if it is to be used to the greatest advantage. Unfortunately, the experimental determination of digestibility is a somewhat costly and lengthy business, and could not economically be adopted to meet general requirements. In consequence, attempts have been made to determine the approximate feeding value of hays from their chemical composition. One of the authors⁸ has published curves whereby the protein and starch equivalents of leafy types of hays can be calculated from their crude protein contents. The protein equivalent values can be determined thus with some accuracy, but fairly large errors may arise in the calculation of the starch equivalents. The curves quoted, when applied to the hays in the present investigation, give rise to some quite large discrepancies, probably owing to the different nature of the hays in the two series. It was decided, therefore, to modify the curves, using the values obtained on the twenty-two samples examined here, which should represent approximately the average types of hays produced in this country.

A search was made to see if any constituent or mixture of constituents of the hay was correlated with the starch equivalent value and it was found that if the starch equivalent was plotted against the sum of 2 parts of crude fibre and 1 part of crude protein, a fairly straight line resulted.

The linear regression equations were therefore calculated for starch equivalent (S) on this sum (x) of 2 parts crude fibre and 1 part of crude protein, and also for the protein equivalent (P) on the crude protein (y). The equations are as follows:—

$$\begin{aligned}\text{Starch equivalent (S)} &= 87.645 - 0.6875x. \\ \text{Protein equivalent (P)} &= 0.7844y - 3.331.\end{aligned}$$

It is perhaps advisable to illustrate the method of using the equations. As an example, a hay may be taken with 15 per cent. of moisture containing 28.71 per cent. of fibre and 7.58 per cent. of crude protein. These must first be calculated to a dry matter basis, e.g. 33.78 per cent. fibre and 8.92 per cent. crude protein in the dry matter.

To calculate the starch equivalent, multiply the fibre content by two ($33.78 \times 2 = 67.56$) and add the crude protein (8.92), which gives a value of 76.48. This is then substituted in the equation:—

$$\begin{aligned}S &= 87.645 - 0.6875x. \\ &= 87.645 - 0.6875(76.48). \\ &= 35.06.\end{aligned}$$

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To calculate the protein equivalent substitute 8.92 in the second equation:—

$$\begin{aligned} P &= 0.7844y && - 3.331. \\ &= 0.7844(8.92) && - 3.331. \\ &= 3.67. \end{aligned}$$

The starch equivalent is 35.06 lb. of dry matter, and the protein equivalent is 3.67 per cent. These must now be corrected for the 15 per cent. of moisture in the hay which, therefore, contains 29.8 lb. starch equivalent per 100 lb. and 3.12 per cent. of protein equivalent in the hay as it is fed. (It is essential to calculate the values to a dry matter basis before substituting in the equations.)

In Table 8 a comparison is made between the starch and protein equivalent values of the hays as determined by experiment and as calculated from the equations given above.

TABLE VIII

STARCH AND PROTEIN EQUIVALENT VALUES AS DETERMINED BY
EXPERIMENT AND AS CALCULATED FROM EQUATIONS

Hay No.	KELLNER STARCH EQUIVALENT			PROTEIN EQUIVALENT		
	Determined	Calculated	Difference	Determined	Calculated	Difference
	(a)	(b)	(a) — (b)	(a)	(b)	(a) — (b)
1	31.4	33.1	— 1.7	3.67	4.62	— 0.95
2	28.8	30.7	— 1.9	5.58	5.84	— 0.26
3	36.0	35.3	+ 0.7	4.76	4.90	— 0.14
4	42.5	39.0	+ 3.5	1.98	1.31	+ 0.67
5	30.4	32.8	— 2.4	2.97	3.35	— 0.38
6	32.6	31.9	+ 0.7	3.10	3.33	— 0.23
7	28.4	34.6	— 6.2	2.84	3.09	— 0.25
8	38.0	39.6	— 1.6	4.13	4.33	— 0.20
9	41.3	38.5	+ 2.8	4.16	3.69	+ 0.47
10	29.5	27.4	+ 2.1	0.52	1.05	— 0.53
11	39.4	37.8	+ 1.6	5.09	5.11	— 0.02
12	39.1	37.3	+ 1.8	4.52	3.86	+ 0.66
13	38.3	36.7	+ 1.6	0.16	0.44	— 0.28
14	35.1	34.1	+ 1.0	4.59	4.48	+ 0.11
15	37.8	35.9	+ 1.9	6.87	6.79	+ 0.08
16	37.9	32.6	+ 5.3	4.23	3.78	+ 0.45
17	34.8	35.2	— 0.4	2.81	2.56	+ 0.25
18	36.0	39.0	— 3.0	3.00	2.80	+ 0.20
19	36.2	38.8	— 2.6	3.25	3.78	— 0.53
20	31.6	32.8	— 1.2	4.98	4.72	+ 0.26
21	34.0	34.2	— 0.2	1.84	1.79	+ 0.05
22	32.3	33.0	— 0.7	5.62	5.13	+ 0.49
	Standard Error		2.62	—	—	0.43

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It will be seen that generally there is very good agreement between the determined and calculated values. In the starch equivalent values only two hays, Nos. 7 and 16, show any relatively large differences, but even errors of such magnitude are not likely to be serious in ordinary feeding practice.

The equations given will not find general application. They are applicable only to meadow hay, and will not be suitable for "seeds" hays or for material of high crude protein content cut at an early stage of growth. For meadow hay as usually cut on the farm, i.e. at an advanced stage of growth, the use of these equations will give values for starch equivalent and protein equivalent which are a closer approximation to their true feeding value than is ever possible by visual examination.

This can be tested by applying the equations to the data given by Kellner⁴ for different types of hay and based on a large number of digestibility trials and covering widely differing conditions. There are five types of hay quoted by Kellner, and the starch equivalent and protein equivalent values given below are contrasted with the values calculated by using the equations.

TABLE IX

THE CALCULATED AND DETERMINED VALUES FOR STARCH EQUIVALENT
AND PROTEIN EQUIVALENT OF HAYS EXAMINED BY KELLNER

(Stated as percentages of the Dry Matter)

Quality of Hay	Crude Protein	Crude Fibre	STARCH EQUIVALENT			PROTEIN EQUIVALENT		
			Determined	Calculated	Difference	Determined	Calculated	Difference
			(a)	(b)	(a)-(b)	(a)	(b)	(a)-(b)
Poor	8.75	39.09	22.05	27.88	- 5.83	3.44	3.93	- 0.09
Medium	10.73	34.07	27.65	33.42	- 5.77	4.55	5.08	- 0.53
Good	11.32	30.69	36.17	37.66	- 1.49	5.36	5.55	- 0.19
Very good	13.76	25.76	42.59	42.76	- 0.17	7.29	7.46	- 0.17
Excellent	16.07	22.96	48.33	45.00	+ 3.33	9.34	9.27	+ 0.07

The agreement between the calculated and the determined values is fairly close, particularly the protein equivalent. It is clear that the equations developed fit the standard values of Kellner, even for hays of high protein content, and since these values are usually accepted, the calculation of starch equivalent and protein equivalent values from the crude protein and fibre values is possible. The series of hays made

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at Jealott's Hill and described elsewhere⁸ have not been included in calculating the equations, since they were all made in Berkshire, and it was considered more desirable not to use them, as they would have given too heavy a local bias. There were ten samples, ranging in crude protein content from 6 to 10 per cent. of the dry matter, and the determined values were higher by 2.80 lb. of starch equivalent than the calculated values (range - 2.42 to + 7.67) and 0.65 per cent. of protein equivalent (range + 0.07 to + 1.27). The agreement is fair, but one or two values showed wide discrepancies. Five samples of early-cut hay, varying in protein content from 10.0 to 15.5, showed an average determined value for starch equivalent which was 7.99 lb. higher than the calculated value, but the protein equivalent was only 0.29 per cent. higher in the determined values. This last-named series shows the poorest agreement, but this was to be expected as the material was leafy and low in fibre, and made under excellent conditions.

The use of the equations will give a fair idea of the nutritive value of a sample of hay, though they would have been more satisfactory if they could have included some values for hay made under really poor weather conditions.

Summary. Twenty-two samples of hays, collected from fifteen counties in Great Britain, have been examined for chemical composition and nutritive value.

All the hays were harvested in 1935, when the weather conditions were almost universally favourable for hay-making.

The content of crude protein in the hays was low, varying from 4.81 to 12.90 per cent., average 8.92 per cent. of the dry matter, and of all the constituents the crude and true protein had the lowest digestibility.

Based on the starch equivalent values, only two samples could be classed as *very good*, twelve as *good*, and eight intermediate between *good* and *poor*. On protein equivalent content, only five could be classed as *good*, six intermediate between *good* and *poor*, and eleven as *poor*.

Equations are given whereby the protein equivalent value can be calculated from the crude protein content, and the starch equivalent calculated from the sum of 2 parts of fibre and 1 part of crude protein.

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Milk Marketing Scheme. Pool prices and rates of producer-retailers' contributions for April, 1937, are given below, with comparative figures for March, 1937, and April, 1936. The monthly wholesale liquid milk price was 1s. 4d. per gal., a reduction of 1d. per gal. on that for the previous month, and the same as in April, 1936.

Region	Pool Prices			Producer-Retailers' Contributions		
	Apr. 1937	Mar. 1937	Apr. 1936	Apr. 1937	Mar. 1937	Apr. 1936
	d.	d.	d.	d.	d.	d.
Northern	12½	13½	11½	3½	2½	4
North-Western	12½	13½	11½	3½	2½	4
Eastern	12½	14	11½	2½	2½	3½
East Midland	12	14	11½	3½	2½	4
West Midland	12½	13½	11½	3½	3½	4½
North Wales	12½	13½	11½	3½	3½	4½
South Wales	12	13½	11½	3½	2½	4
Southern	12½	14½	11½	2½	2½	3½
Mid-Western	12	13	11½	3½	3½	4½
Far-Western	12	13	11½	3½	3½	4½
South-Eastern	13	14	12½	2½	2½	3½
Unweighted Average	12·45	13·82	11·52	3·16	2·82	3·98

These prices are exclusive of any premiums for special services and level deliveries, and also of the Accredited Producers' premium of 1d. per gal. The sum required for the payment of the latter premium was equivalent to a levy of 348d. per gal. on pool sales.

The inter-regional compensation levy was fixed at 2d. per gal., compared with 2½d. per gal. in April, 1936.

Sales on wholesale contracts were as follows:—

	April, 1937 (estimated)	April, 1936
	Gal.	Gal.
Liquid	47,764,718	45,435,419
Manufacturing	25,043,243	31,593,504
	<hr/> 72,807,961	<hr/> 77,028,923
Percentage liquid sales	65·60	58·98
Percentage manufacturing sales	34·40	41·02

The average realization price of manufacturing milk during April was 5·29d. per gal. compared with 4·95d. per gal. for April, 1936. The quantity of milk manufactured into cheese

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on farms was 1,323,449 gal. compared with 547,080 gal. in the previous month and 1,342,723 gal. in April, 1936.

Hops Marketing Scheme. The Annual General Meeting of registered producers was held on May 7, and the four retiring special members of the Board were re-elected for a further year.

Total consignments to the Board, of 1936 hops, amounted to 229,030 cwt., of which 215,167 cwt. were sold up to March 31, 1937. As sales are less by nearly 10,000 cwt. than the estimated demand of 225,000 cwt., the call on the levy fund, to make up an average price of £9 per cwt. on the estimated demand, will be approximately £83,000. It has been agreed that the cost of storing the unsold hops shall be borne by the levy fund up to October 31, 1937. Advances representing 96 per cent. of the valuation of quota hops have already been made to producers, and a final payment of 4 per cent. will be made on settlement of the claim against the levy fund.

Potato Marketing Scheme. *Sale of "Seconds."* During the period November 1, 1936, to April 30, 1937, permits for the sale of "Seconds"—potatoes which pass through a riddle of $1\frac{5}{8}$ in. but stand on a riddle of $1\frac{1}{4}$ in.—have been issued by the Potato Marketing Board for a total quantity of approximately 23,000 tons.

Consumers' Committees. Miss D. S. Tomkinson, O.B.E., M.A., J.P., who has been appointed a member of the Food Council, has also been appointed a member of the Consumers' Committees for Great Britain and for England.

Milk Acts, 1934 and 1936: *Manufacturing Milk.* No advances have been made by the Ministry in respect of manufacturing milk since April 15, 1937; there is therefore no alteration in the figures given in last month's issue of this JOURNAL.

Milk-in-Schools Scheme. No further claims have been paid between April 15 and May 15, 1937, in respect of milk supplied to school children at reduced rates. The figures shown last month also remain unaltered.

Cheese-Milk Price. For the purpose of payments under the Milk Acts (whether by the Exchequer to Milk Marketing Boards or by Boards to the Exchequer) in respect of milk used for manufacture, the cheese-milk price has been certified by the Minister and the Secretary of State for Scotland to

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be 5·92 pence per lb. for the month of May, 1937. No advances are, therefore, payable in respect of milk manufactured in Great Britain during May.

Nutrition Survey. A summary of the first report presented to the Milk Nutrition Committee will be found on page 201 of this issue of the JOURNAL.

Wheat Act, 1932: *Sales of Home-Grown Wheat, Cereal Year, 1936-37.* Certificates lodged with the Wheat Commission by registered growers during the period August 1, 1936, to April 30, 1937, cover sales of 19,114,638 cwt. of millable wheat as compared with 28,851,559 cwt. in the corresponding period (to May 1,) in the last cereal year.

Sugar Industry (Reorganization) Act, 1936: *Results of the 1936-37 Campaign in Great Britain.* A comparative summary of the beet sugar manufacturing campaigns 1935-36 and 1936-37 is given below.

	1936-37.	1935-36.
Total acreage under sugar beet	355,421	374,753
Less acreage grown for seed	511	606
Total net acreage grown under contract for delivery to factories (a)	354,910	374,147
Tonnage of beet delivered to factories ..	3,448,008	3,403,989
Average yield of beet per acre (tons) ..	9·7	9·1
Average sugar content of beet (per cent.) ..	17·3	16·4
Average farm output of sucrose per acre of beet (lb.)	3,765	3,342
Average price paid per ton of beet delivered to factories	39s. 9d.	38s. 10d.
Total sum, including cost of transport paid by factories to growers	£6,853,000	£6,609,000
Number of beet growers	40,303	44,819
Average acreage per grower	8·8	8·3
Number of factories	18	18
Average number of days worked at factories ..	97	98
Average number of workers employed in the factories during the campaign	9,600	9,500
Production of sugar :		
(i) of all polarizations (tons)	537,366	487,325
(ii) in white equivalent (tons)	521,944	471,704
Average extraction of sugar expressed as a percentage of the beet delivered to factories		
(i) all polarizations	15·6	14·3
(ii) white equivalent	15·1	13·9
Average factory output of manufactured sugar per acre of beet :		
(i) all polarizations (lb.)	3,392	2,918
(ii) white equivalent (lb.)	3,294	2,824

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Average extractions of sugar expressed as a percentage of the total sucrose in the beet:	1936-37.	1935-36.
(i) all polarizations	90.1	87.1
(ii) white equivalent	87.5	84.5
Production of by-products :		
Molasses (tons) ..	110,641	123,786
Pulp : Dry (tons) ..	278,578	276,739
Wet (tons) ..	83,967	116,324
Average extraction of molasses expressed as a percentage of the beet delivered to factories	3.2	3.6
Direct Exchequer assistance paid on sugar produced	£2,576,019	£2,623,467(b)
(a) Calculations made in relation to acreage are on a net acreage basis.		
(b) Includes £404,955 for capital services under the terms of Section 16 of the Sugar Industry (Reorganization) Act, 1936 (£240,000 depreciation and £164,955 interest charges).		

Livestock Industry Bill. This Bill, the passage of which through Standing Committee was completed on April 13, was re-committed on May 3 to a Committee of the whole House of Commons in respect of amendments to certain clauses, following which Report Stage was taken and, on May 4, the Bill received a Third Reading. The Bill is now before the House of Lords.

Cattle Fund. The following table gives particulars of payments made under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936.

	Payments	Animals	Average payment per Animal
	£		£ s. d.
April, 1935	276,593	115,545	2 7 10½
April, 1936	316,021	133,837	2 7 2½
April, 1937	356,540	150,108	2 7 6
*Sept. 1, 1934 to April 30, 1937	10,236,594	4,317,951	2 7 5

* Commencement of subsidy payments.

National Mark Honey. When the National Mark Honey Scheme was introduced, standard glass jars of a particular design registered in the Minister's name were prescribed for the packing of National Mark honey. The possibility of introducing an improved design was recently considered by the National Mark Honey Trade Committee at a meeting that

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was attended by representatives of the Glass Manufacturers' Federation and by other interested parties who were invited to express their views on this point. After consideration of those views, the Trade Committee recommended the adoption of certain modifications suggested by the Glass Manufacturers' Federation. Specimens of the proposed new jars, with different types of neck and fitted with caps of various depths, will be submitted by the Federation in due course for the consideration of the Trade Committee.

When the new standard jars are approved by the Ministry they will supersede the present jars, but a transitional period will be allowed during which existing stocks of the latter may be used.

National Mark Wheat Flour Scheme: *Substitution of "Wheatmeal" Grade for "Wholemeal" Grade.* On the recommendation of the National Mark Wheat Flour Trade Committee, the Minister of Agriculture and Fisheries has given notice of his intention to amend the Agricultural Produce (Grading and Marking) (Wheat Flour) Regulations, 1933. The Draft of the Amending Regulations—the Draft Agricultural Produce (Grading and Marking) (Wheat Flour and Wheat Flakes) Regulations, 1937—will shortly be placed on sale by H.M. Stationery Office.

The amending regulations, besides providing for the substitution of the grade designation All-English (Wheatmeal) or National Mark Wholemeal in place of All-English (Wholemeal) or National Mark Wheatmeal, also include the following requirements in the definition of quality with respect to wheatmeal:—

- (1) The meal shall comprise at least 90 per cent. of the ground products of the wheat. No bran may be added thereto or flour extracted therefrom.
- (2) The *ash content* shall exceed 1 per cent., but shall not exceed 1.7 per cent. of the total weight of the meal calculated on the basis of 15 per cent. moisture content, and, on this same basis, the *fibre content* shall exceed 1 per cent. but shall not exceed 2 per cent.

The opportunity has been taken of incorporating in the Draft Regulations the provisions of the Agricultural Produce (Grading and Marking) (Wheat Flour) (Amendment) Regulations, 1935, which prescribe a grade designation and a definition of quality for wheat flakes.

MARKETING NOTES

National Mark Dressed Poultry. Reports on market and other inspections made during the past twelve months indicate that the National Mark Dressed Poultry Scheme is having a greater influence on poultry marketing than is indicated by the actual numbers of birds that were packed under National Mark labels. The methods of packing and marketing, which the Scheme sets out to encourage, are apparently being widely adopted by progressive producers and packers throughout the country.

An interesting innovation is beginning to take shape in regard to the type of non-returnable containers used for the packing of supplies, and the half-dozen unit is becoming more popular. Fibre-board cases are being used and are proving satisfactory and economical. There is, however, still room for improvement both in design and durability.

Arrangements have been made for the continuance, at a number of shows during the coming season, of competitive classes for market packs of table poultry. The inauguration of these classes has proved to be of considerable educational value, and as a result, technique has steadily improved both as regards production and presentation.

Marketing Demonstrations. Particulars of exhibits and demonstrations to be staged by the Ministry during June and early July are as follow:—

<i>Show</i>	<i>Demonstration</i>
Royal Counties, Reading June 2-5.	Tomato grading demonstration. Honey and dairy produce exhibits.
Suffolk County, Beccles June 3-4	Apple grading, egg testing, and livestock demonstrations. Egg, table poultry, honey and vegetable exhibits.
Three Counties, Hereford June 8-10.	Egg testing and fruit grading demonstrations. Fruit, egg, table poultry and honey exhibits.
Essex County, Maldon. June 9-10.	Tomato grading demonstration. Table poultry exhibit.
Lincoln County, Spalding June 16-18.	Egg testing and grading, and livestock demonstrations. Egg and vegetable exhibits.
Northampton County, Kettering .. June 23-24.	Egg testing and fruit grading demonstrations. Table poultry and egg exhibits.
Aldershot July 1-3.	Egg grading demonstration. National Mark exhibit.
Royal, Wolverhampton July 6-10.	Egg testing, fruit grading and livestock demonstrations. Fruit, dairy produce, egg and honey exhibits.

ACCOMMODATION OF PICKERS OF HOPS, FRUIT AND VEGETABLES

FOLLOWING consultation with the Ministry of Agriculture and Fisheries and with representatives of Local Authorities and of agricultural interests, the Ministry of Health has prepared for the guidance of local authorities, a revised model series of Byelaws relating to the lodging and accommodation of persons engaged in the picking of hops, fruit and vegetables. The revised model series, a copy of which is appended below, is based on the existing model which, however, has been recast in more convenient form. The following additional requirements have been incorporated in the revised model series :—

- (a) The floor of a new lodging must be constructed of some impervious material : clause 2 (ii) ;
- (b) A new lodging, while it is occupied, must be maintained free from any obstruction from behind so near as to interfere with the access of air and light : clause 2 (iv) ;
- (c) At least fourteen days' written notice (instead of three days) of the intention to use a lodging in any year after the year in which it was erected must be given to the local authority : clause 3 (i) ;
- (d) Where a building has been used for animals, it must not be used as a lodging until at least ten days have elapsed since their removal therefrom, and the building has been properly cleansed and lime-washed or treated with some other suitable form of disinfectant : clause 3 (iv) ;
- (e) The person providing a lodging must secure that when a person sleeps upon the ground floor there shall be a space of not less than three inches between the ground and the bed upon which that person sleeps unless the floor is made of impervious material : clause 3 (vii) ;
- (f) Suitable and sufficient receptacles for refuse must be provided and maintained in good repair and in a clean and wholesome condition : clause 3 (viii) ;
- (g) At least *twenty* square feet (instead of eighteen square feet) of available floor space must be allowed in respect of each person for sleeping.

Two children under *ten* (instead of twelve) years of age are to be counted for this purpose as one person.

"Adult person" is defined to mean a person exceeding the age of *ten* (instead of twelve) years : clause 3 (x) ;

- (h) The accommodation for the cooking of food and the drying of clothes and other articles must include accommodation for the drying of bedding. The accommodation must consist of a properly constructed fire grate, or of fire place accommodation measuring laterally not less than four feet for every sixteen persons (i.e. pot-rail system) : clause 3 (xii) ;
- (i) A supply of water must be situated not more than one hundred and fifty yards from the lodging : clause 3 (xiii) ;

ACCOMMODATION OF PICKERS OF HOPS, ETC.

- (j) Sanitary accommodation must provide individual privacy for women, afford protection from the weather, and be maintained in a clean and inoffensive condition. The accommodation for men must be separated from that for women and children by at least twenty-five feet or have separate entrances invisible the one from the other : clause 3 (xiv) ;
- (k) Any part of a lodging which is above the ground floor and intended for sleeping must be provided with adequate access from and to the level of the ground by an *external* stairway or stairways : clause 3 (xv) (a).

The Ministry of Health has sent copies of the revised model series of Byelaws to the Local Authorities of those districts where it is known that imported labour is used for the picking of hops and has asked them to give it their early consideration, and, if they propose to make new byelaws, to take early steps to see that they come into force before this year's hop-picking season commences. It is also understood that the Department is preparing a booklet for circulation by Local Authorities to growers, for their guidance in meeting the requirements of the new byelaws.

Model Byelaws—relating to the lodging and accommodation of hop-pickers and pickers of fruit and vegetables.
Draft form as revised in May, 1937.

Byelaws made by the¹

for securing the decent lodging and accommodation of persons engaged in hop-picking or in the picking of fruit and vegetables in²

1. In these byelaws " the Council " means the¹

¹ Insert " Mayor, Aldermen, and Burgesses of the Borough of _____, acting by the Council ", or, " Urban [or Rural] District Council of _____ " ; *as the case may be.*

² Insert " the Borough of _____ " or " the Urban [or Rural] District of _____ " ; *or, if the byelaws are to apply to part only of a rural district, " that portion of the Rural District of _____ which comprises the contributory places of _____, as the case may be.*

Erection of New Lodgings.

2. Any person who erects a new lodging not intended to be ordinarily occupied for human habitation for persons engaged in hop-picking or in the picking of fruit and vegetables shall comply with the following rules :—

(i) He shall, before commencing to erect a new lodging, give to the Council at least *twenty-eight days'* written notice of his intention so to erect it.

(ii) He shall cause the ground floor to be constructed of some impervious material.

ACCOMMODATION OF PICKERS OF HOPS, ETC.

(iii) He shall provide and, while the lodging is occupied, maintain in front of it (or, where lodgings form a block, in front of each such block) an open space free from any erection and exclusively belonging to or used with the lodging or block which shall extend—

(a) to a distance of *fifteen feet* if lodgings or blocks are not erected face to face,

(b) to a distance of *twenty feet* between lodgings or blocks erected face to face.

(iv) He shall so place it that there is not behind it any obstruction so near as to interfere with the access of air and light, and while it is occupied he shall maintain it free from any such obstruction.

General Provisions.

3. Any person who provides any lodging not ordinarily occupied for human habitation for persons engaged in hop-picking or in the picking of fruit and vegetables shall comply with the following rules:—

(i) ¹He shall before the lodging is used in any year after the year in which it was erected, give to the Council at least *fourteen days'* written notice of his intention so to use it.

¹ *In the case of lodgings provided for persons engaged in the picking of fruit the local authority will no doubt consider whether the period should not be reduced to seven days.*

(ii) He shall not permit the lodging to be used unless its site is reasonably free from damp and the lodging is clean, dry and weather-proof and shall cause the lodging to be cleansed immediately before each occasion on which it shall be occupied.

(iii) He shall cause the lodging to be provided with proper and sufficient means of ventilation and lighting by natural light.

(iv) If the building has been used for animals he shall not permit it to be used as a lodging until an interval of at least *ten days* has elapsed since their removal therefrom, and the building has been properly cleansed and lime-washed or treated with some other suitable form of disinfectant.

(v) He shall cause every part of the interior of the lodging, and of any cooking-house, privy, or other premises in connection therewith, to be thoroughly cleansed immediately before the lodging is used in any one year.

He shall cause the walls and ceilings of every room to be well and sufficiently lime-washed or treated with some other suitable form of disinfectant *once in every year not more than two months before occupation.*

(vi) He shall provide for every person received into the lodging a sufficient supply of clean, dry, and suitable bedding, which if it be straw or other similar bedding shall not have been previously used, and shall renew it from time to time as may be reasonably necessary.

(vii) He shall secure that when a person sleeps upon the ground floor there shall be a space of not less than *three inches* between the ground and the bed upon which that person sleeps unless the floor is made of impervious material.

(viii) He shall provide for the persons received into the lodging or block of lodgings, suitable and sufficient receptacles for refuse at a rate of not less than one for each *sixteen persons* and shall maintain the same in good repair and in a clean and wholesome condition.

(ix) He shall cause all accumulations or deposits of refuse filth or any offensive or noxious matter to be removed daily from the lodging and from the land surrounding or adjoining it of which he is the occupier.

ACCOMMODATION OF PICKERS OF HOPS, ETC.

(x) ¹He shall not cause to be received into the lodging or into any room therein at any one time for sleeping a greater number of persons than will allow *twenty square feet* at the least of available floor space in respect of each person.

¹ *It is suggested in connection with this byelaw that Local Authorities should print placards with spaces left blank for the figures. These placards could be given to the farmers with a suggestion that, to prevent contraventions of the byelaws and in their own interest, they should put them up in the huts.*

For the purpose of this rule *two children under ten years* of age shall be counted as *one person*.

(xi) He shall

(a) cause every room or part of the lodging which may be intended to be used for sleeping by adult persons of different sexes to be divided into compartments in such a manner that every compartment shall be separated from every other compartment by a screen or partition of such material, construction, and height as to secure privacy to the occupant or occupants of the compartment when so used ;

(b) not cause any compartment to be appropriated for the use of adult persons of different sexes.

Provided that this rule shall not be deemed to prohibit the appropriation of a compartment for the exclusive use of a single family comprising the following persons or any of them, that is to say, a husband and his wife and their children not exceeding the age of *fourteen years*.

For the purpose of this rule " adult person " means a person exceeding the age of *ten years*.

(xii) He shall provide, in a safe and suitable position in or in connection with or adjacent to each lodging or block of lodgings, a suitable cooking-house or other place, properly covered and sheltered from the weather, in which fires may be safely and readily lighted and food may be properly cooked and clothes, bedding and other articles may be properly dried.

He shall cause the cooking-house or place to be so constructed and, while the lodging or block of lodgings is occupied, so maintained that for every *sixteen persons* received in the lodging or block of lodgings there is separate accommodation for the cooking of food and the drying of clothes, bedding and other articles, and such separate accommodation shall consist either of a properly constructed fire-grate or of fire-place accommodation measuring laterally not less than *four feet*.

For the purpose of this rule, any number of persons in excess of *sixteen* or a multiple of that number shall be deemed to be *sixteen*.

(xiii) He shall (where it is not otherwise readily available) provide in or upon or in connection with the lodging, or in some suitable place readily accessible therefrom, such a supply of good and wholesome water as will at all times suffice for the reasonable requirements, whether for drinking, cooking, or washing, of the several persons received into the lodging.

For the purpose of this rule a supply of water shall not be deemed to be readily available or accessible if it is situated at a greater distance than *one hundred and fifty yards* from the lodging.

(xiv) He shall provide, in a suitable and convenient position in connection with every lodging or with every group of lodgings, water-closets, earthclosets or privies, properly constructed (and, in the case of earthclosets and privies, of sufficient depth) for the separate use of each sex, and at a rate of not less than one for every *twenty persons*.

ACCOMMODATION OF PICKERS OF HOPS, ETC.

The waterclosets, earthclosets, or privies shall

- (a) provide individual privacy for women,
- (b) afford protection from the weather,
- (c) be maintained in a clean and inoffensive condition, and
- (d) be marked MEN and WOMEN AND CHILDREN respectively, and those marked MEN shall be separated by at least *twenty-five feet* from those marked WOMEN AND CHILDREN, or have separate entrances invisible the one from the other.

He shall cause the contents of earthclosets and privies to be covered *once* each day with dry earth or other suitable absorbent material and removed when necessary. He shall cause the contents of movable receptacles used for such purposes to be removed daily.

(xv) He shall, where any part of the lodging which is above the ground floor may be intended to be used for sleeping—

- (a) cause that part to be provided with adequate access from and to the level of the ground by an external stairway¹ or stairways ;
- (b) cause to be provided in connexion with any such part which may be used by more than ²persons, at least

¹ "stairway" is used here to describe a means of access with flat treads, i.e. something more than a ladder with rungs. The word does not imply what is known in building as a "staircase."

² "fifteen" has been suggested here, but, if the Local Authority consider this too high, the Minister will agree to "ten" or some intermediate figure.

two means of access extending to the level of the ground, one at least of which shall be approached by a door opening outwards from within on to a proper landing ;

- (c) cause all means of access (including any stairs and landings) to be substantially constructed.

Penalties.

4. Every person who shall offend against any of the foregoing byelaws shall be liable on summary conviction to a fine not exceeding *five pounds*, and in the case of a continuing offence to a further fine not exceeding *forty shillings* for each day during which the offence continues after conviction therefor.

Repeal of Byelaws.¹

¹ *If there are no byelaws in force, this should be stated and the clause struck out.*

5. The byelaws for securing the decent lodging and accommodation of persons engaged in hop-picking, or in the picking of fruit and vegetables, which were made by the _____ on the _____ day of _____ and were confirmed by the [Local Government Board] [Minister of Health] on the _____ day are hereby repealed.

JUNE ON THE FARM

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THE present month is one during which some indication of the abundance of the harvest and winter keep is usually obtained. It is perhaps the month during which, in normal seasons, the greatest growth takes place.

As far as cereal crops are concerned it may be that cleaning, rolling and all cultural operations are finished, but much may be learnt from frequent and careful observation of the crop during the month. Lime and other plant food deficiencies are often revealed in unevenness of growth, lack of vigour and reaction to adverse weather conditions. Faulty drainage is usually evidenced in the crop. While it may be too late to do anything for the present season, the information should be duly noted and acted on at the most suitable time.

In the April notes reference was made to the value of mechanization in helping forward cultivation work, especially in a late spring. The prices realized at recent farm sales for tractors and farm horses with the necessary equipment indicate how the law of supply and demand very quickly affects prices. The concentration of a large amount of spring work in a short rush period has put prices to a high level. At one farm sale in the north of England during May a tractor eighteen months old realized over 10 per cent. more than present new price, while horses suitable for farm work have been in very keen demand.

Pasture. The adjustment of the stocking to the particular grazing areas is one of the important questions to be decided by the farmer. Numbers, periods of stocking and intensity of grazing are all factors involved. In this month the farmer should be able to form a fairly accurate judgment as to whether his fields are adequately stocked. The saying "What is grown in May should be eaten in May," indicates amongst other things that grass should not be allowed to run to stem. Recent knowledge has confirmed the desirability of keeping grass leafy as long as possible and efficient grazing stimulates the tillering properties of pasture plants. At the same time overgrazing at this time of the year may be definitely *harmful, and greatly increase the risk of considerable*

JUNE ON THE FARM

difficulty should drought ensue in mid-season. This is especially the problem of the south country grazier.

The tendency on many farms to overstock with sheep is not only harmful from the point of view of the health of the sheep, but also tends to reduce the productivity of the pasture. Sheep alone are not good grazing stock, particularly on permanent pasture, as they have powers of discrimination in grazing and take out the finer bottom leaves, leaving the flowering stems to produce flowers and seed. The result of a pasture plant being allowed to produce seed is that the plant is reduced in vitality and production is not so great in the following year. Sufficient cattle stock to keep the pasture plants from running to seed should be aimed at.

Cake Feeding on Grass. The advisability of feeding cake on grass land is frequently under discussion. The results of cake feeding on grass land at Cockle Park on both Tree Field and Hanging Leaves fields indicates that cake feeding is not an economic means of improving grass land. The returns from dressings of basic slag have given much more economic live-weight gains in both cattle and sheep. It should be borne in mind that the Cockle Park experiments were designed to test the value of cake feeding as a means of improving grass land. The cattle used in the experiments have always been young growing animals.

Where the object of cake feeding is beef production the feeding of concentrates in addition to pasture may be quite profitable. The results of trials carried out at Auchincruive and reported by Principal Paterson indicate that a very satisfactory return may be obtained from judicious cake feeding—in fact, the cake feeding gave more economic returns than manuring. The cattle were better finished and commanded a higher price per cwt. In reporting on this experiment Principal Paterson states that "As compared with the improvement effected by manuring, the feeding of concentrates contributes to more rapid as well as to more economic beef production."

As with most other questions in farming, it is difficult to generalize, each farm or district having to be considered in the light of its own particular circumstances and its particular grazing conditions. The now famous East Northumberland grass feeding areas are practically entirely maintained by the use of phosphates, and cake feeding is not the general rule.

JUNE ON THE FARM

The indications from the Cockle Park results are that, under certain conditions, a better balance between expenditure on cake and that on fertilizers would lead to better returns.

Hay Making. There can be no doubt that good hay is the basis of successful winter feeding with most classes of farm stock. Soil, climate, manuring and management all play an important part in determining quality. Management and weather conditions are the factors that may be considered here. Time of cutting is an important factor as affecting quality. It has been stated that there is as much food value in the plant just before it comes into flower as at any stage of its growth, and as maturity proceeds the food value deteriorates. The practical difficulty of "winning" or making into hay immature grass or clover is well known. Air cannot get through the cut swath; it takes longer to make; and, as a rule, the product is not so palatable. On the other hand, if cutting is delayed until the plants have become too mature there is loss due to seed falling out and the stems have become woody and less digestible. Very late-mown hay in some instances corresponds to a partially threshed corn crop. Two advantages are obtained from cutting the crop before it reaches an over-mature stage: (1) the hay produced is of better feeding value, and (2) the plants retain vigour and give a more abundant aftermath. In permanent meadows it will be found that early cutting results in more vigorous growth in the following spring.

It might be noted that with newly-laid-down permanent or temporary grass land it is particularly important that cutting should be done early when a hay crop is taken in the first year as it greatly helps in the grasses and clovers becoming established.

Weather is a determining factor. No matter how good a hay crop may be, its value can be greatly reduced by an unfavourable harvest. In this connexion there are now many implements and appliances that greatly help the farmer to make the most use of any favourable spells of weather when they occur.

Sheep. During June the chief operation with the sheep flock is the clipping of the ewes and young sheep on lowland farms. Before clipping there is constant need for shepherding on account of the risk of ewes getting on their backs. With the advent of warmer weather the enemies of the sheep

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become active and great care needs to be exercised in order to keep sheep clean and free from dirt, which encourages the attack of the sheep maggot. Observations in Australia have shown that dirty sheep are more prone to attack than clean sheep. At the first suggestion of trouble by the appearance of maggots, dipping should be carried out—prevention is always better than cure. All shepherds know how very quickly an animal becomes badly mutilated if a maggotted sheep is overlooked.

It is of interest to note that in different parts of the country the ravages of stomach worms in sheep vary in seasonal activity. For example, in the south-west the chief trouble from parasitic disease is noted mainly in the autumn months, and in these counties very heavy losses have been recorded during the last few years.

In many northern counties, however, the menace of internal parasites is evident very much earlier, and farmers commonly adopt preventive measures some time in June.

The symptoms of worm infestation are that some of the lambs cease to thrive, and diarrhoea may or may not appear. Where diarrhoea does occur some lambs become very weak and the worst may actually die before the trouble is diagnosed. In other instances, where no diarrhoea occurs, the unthriftiness is accompanied by dryness of the skin, and it is important for the farmer to realize that the trouble is parasitic, even in the absence of other apparent symptoms like diarrhoea.

In all probability the varying symptoms are produced by the presence of different species of worm parasites. Where parasitic troubles are suspected it is best to obtain the advice of a veterinary surgeon. An accurate diagnosis may be made by examining the faeces, or more simply by opening a dead lamb. The recognized treatment is to use a solution of copper sulphate, and excellent results have been obtained in the Northern Province from the use of nicotine mixture. Whatever method of treatment is adopted it is wise to be guided by the veterinarian.

Root Crops. The singling of root crops will occupy a good deal of time during this month. This operation is still mainly carried out by hand labour and is therefore costly. Too much emphasis cannot be laid on the importance of careful and efficient work. Trials with sugar-beet have demonstrated in a striking manner the difference in results between good and

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indifferent singling. The difficulty of obtaining a plant, owing to "fly" and other troubles, makes the root crop a speculative one. It is therefore most desirable not to lose anything by carelessness in singling.

Root crops are usually regarded as cleaning crops, but it should always be borne in mind that they only facilitate cleaning operations. The weeds have to be got rid of if the land is to be cleaner as a result, and horse and hand hoeing should be well and efficiently carried out. With hand hoeing particularly, there is need for efficiency. How often can the differences in the work of individual workers be seen in the growing crop later in the season!

The after-cultivation of the potato crop may exercise a marked influence upon the development of the crop. Frequent and thorough drill cultivation as time and weather permit will usually repay the farmer. The drill cultivation should not only take into consideration the control of weeds but also the promotion of favourable soil conditions for the crop. It is desirable that drill cultivation should be carried out in the early stages of growth, as when the plants become well grown there is danger of damage of the young roots with a resultant check. It is always well to bear in mind that cultivations may have an adverse effect on the soil if they are not carried out under favourable conditions. An examination of the crop will reveal the vigour and purity of stock. Growers should be prepared to discard weak or impure stocks. Lack of vigour or evidence of disease should guide the grower as to whether a stock should be saved for another year. During the month application should be sent in to the Ministry of Agriculture for the inspection of growing crops for purity. Official certificates are issued to those growers whose crops fulfil the conditions of inspection, and such certificates are a useful guarantee, helpful to both purchaser and seller alike.

PRICES OF ARTIFICIAL MANURES ... ..	81

Description.	Average prices per ton (2,240 lb.) during week ended May 5.				
	Bristol	Hull	L'pool	London	Costs per Unit¶
Nitrate of Soda (N. 15½%) ..	£ s. 7 12c	£ s. 7 12c	£ s. 7 12c	£ s. 7 12c	s. d. 9 10
„ „ Granulated (N. 16%) ..	7 12c	7 12c	7 12c	7 12c	9 6
Nitrate of Lime (N. 13%) ..	7 0c	7 0c	7 0c	7 0c	10 9
Nitro-Chalk (N. 15½%) ..	7 5c	7 5c	7 5c	7 5c	9 4
Sulphate of Ammonia:—					
Neutral (N. 20·6%) ..	7 5c	7 5c	7 5c	7 5c	7 0
Calcium Cyanamide (N. 20·6%)	7 5d	7 5d	7 5d	7 5d	7 0
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 0	4 17	4 15	4 17	3 3
„ „ (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%)	8 3	8 1	7 17	8 1	3 3
Sulphate „ (Pot. 48%)	9 15	9 13	9 9	9 13	4 0
Basic Slag (P.A. 15½%) ..	2 12b	2 5b	..	2 10b	3 2
„ „ (P.A. 14%) ..	2 8b	2 0b	2 0b	2 6b	3 3
Grd. Rock Phosphate (P.A. 26-27½%) ..	2 12a	..	2 10a	2 5a	1 8
Superphosphate (S.P.A. 16%) ..	3 4	..	3 3c	3 0f	3 9
„ „ (S.P.A. 13½%) ..	3 1	2 17	2 19e	2 16f	4 1
Bone Meal (N. 3½%, P.A. 20½%)	..	6 10	7 5g	7 0	..
Steamed Bone Flour (N. ½%, P.A. 27½%-29½%) ..	5 5½	5 10	5 0g	5 0	..

Abbreviations: N.=Nitrogen;
S.P.A.=Soluble Phosphoric Acid;

P.A.=Phosphoric Acid;
Pot.=Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 4-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 4 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra, for lots of 10 cwt. and under 1 ton, 15s. extra, and for lots of less than 10 cwt. but not less than 2 cwt., 20s. extra.

e Prices shown are f.o.r. Widnes.

f Prices shown are f.o.r. northern rails; southern rails 1s. 3d. extra.

g Prices shown are f.o.r. Appley Bridge.

h Price shown is f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent. nitrogen contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Principal, Harper Adams Agricultural College.

The Assessment of Productivity of Grassland. It has long been recognized that the weight of produce obtainable from an area of grassland is not a reliable measure of its productive capacity, since the nutritive value of the produce may vary between wide limits. Even when supplemented by determinations of chemical composition and digestibility a considerable element of uncertainty still remains, since the nutritive efficiency of the digestible matter can only be roughly assessed unless elaborate metabolism experiments can be carried out.

This patent weakness of analytical methods to furnish the desired information has led grassland investigators to attempt direct measurement by way of liveweight increase, milk production, etc., recorded by stock grazed on the area. The classic example of this method is furnished by the Cockle Park experiments in which the effects of different manurings were assessed by comparisons of the liveweight gains recorded by grazing stock, and it has been followed by others here and elsewhere. Apart from the obvious difficulties of closely adjusting the density of stocking to the variable amount of grazing available, the method suffers from the serious defects that liveweights are difficult to measure accurately, and the nature of the liveweight increase tends to vary as the animal grows, so that liveweight alone is an unreliable measure of nutritive effect. In the young animal the liveweight increase put on is much richer in water and protein, and poorer in fat, and therefore less concentrated in energy, than the material deposited in the body at later stages when the animal is approaching maturity. One and the same food supply, if equally suitable for both classes of animals, may thus be expected to give a greater liveweight increase with young animals than with older animals.

A similar, though smaller, variation in the nature of the liveweight increase may also arise, especially in the young animal, through variations in the protein content of the fodder.

The difficulties occasioned by these factors are not peculiar

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to grassland feeding experiments, but apply to all feeding experiments with growing animals in which results are assessed in terms of liveweight increase. The problem received much attention from the late Professor Wood, whose conclusions with cattle, sheep and pigs are embodied in his feeding standards. In its application to grassland studies it came under discussion at the third International Grass Land Congress held at Zurich in 1934, and inspired the late Professor Wiegner to an attempt to devise a more satisfactory basis for the interpretation of the results of feeding experiments, the results of which for growing cattle were published shortly after his death last year.

In arriving at the method set out in his paper he started out by examining the question as to how much energy (expressed as "starch equivalent") is required to produce in the bodies of growing cattle one kilogram of body protein and of body fat respectively, and arrived at the conclusion that each kg. of fat stored in the body requires 4 kg. of starch equivalent in the food, whilst each kg. of protein stored in the body requires 1.36 kg. of starch equivalent in the food (in the form of protein).

If, then, we know how much fat and protein respectively are present in the liveweight increase put on by the animal at each particular stage of growth we can calculate the amount of production food (expressed as starch equivalent) that must have been consumed to produce this increase. When to this is added the maintenance requirement we arrive at an estimate of the total food consumption.

For guidance as to the body composition of young cattle at different liveweights Wiegner devised an equation based upon the American data from Haecker's experiments, which led to the results summarized, with slight approximations, in the following table (1 kg. = 2.2 lb.):—

<i>Liveweight</i>	<i>Total Weight of Fat in Body</i>	<i>Total Weight of Protein in Body</i>	<i>Total Production of Food (expressed as Starch equivalent) stored in Body</i>
<i>kg. - (lb.)</i>	<i>kg.</i>	<i>kg.</i>	<i>kg. = (lb.)</i>
50 (110)	2.0	10.1	21.8 (48)
100 (220)	7.2	19.4	55.0 (121)
200 (440)	25.4	37.3	152.3 (335)
300 (660)	53.3	54.6	287.5 (633)
400 (880)	90.2	71.7	458.1 (1,008)
500 (1,100)	135.6	88.4	662.5 (1,458)
600 (1,320)	189.2	105.0	899.4 (1,979)
700 (1,540)	250.7	121.4	1167.6 (2,569)

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From the weights of fat it is clear that in the earliest stages, up to about 500 kg., the animals from which these data were derived were growing with only a moderate degree of fattening.

The data in the last column are arrived at by multiplying the weights of body-fat by 4.0, and those of body-protein by 1.36 (see above), and adding the two products together. They represent, in terms of "production starch equivalent," the estimated amounts of "production food" (i.e. food over and above maintenance requirement) that must have been consumed in order to produce the amounts of fat and protein present in the animal's body at each liveweight.

From these data it is simple to calculate the average amounts of starch equivalent required for each 1 kg. (or 1 lb.) of liveweight increase put on in the separate 100 kg. (or 220 lb.) intervals of liveweight, which work out as follows:—

<i>Liveweight</i>						<i>Kg. Starch Equivalent required as Production Food for 1 kg. Liveweight Increase</i>
<i>kg.</i>						<i>kg.</i>
under 100	.	.	..	..	..	0.66
100-200	.	..	..	.	..	0.97
200-300	..	..	..	..	..	1.36
300-400			.	..	.	1.71
400-500	..	.	..	..	..	2.04
500-600	..	..	..	..	..	2.37
600-700	..	..	..	..	..	2.68

These results are appreciably lower than the "standards" drawn up by Kellner, Armsby and others, but this is to be expected, since the method used in arriving at them must tend to give minimum figures that could only be attained in practice under the most favourable conditions of nutrition. They must certainly be raised somewhat for application to the determination of the productivity of grassland. It is hardly worth while therefore to go into as much detail as the above table suggests, requiring a new factor for each 100 kg. increase of liveweight. Wiegner proposed therefore that for practical purposes the appended simplified table should be used:—

<i>Liveweight</i>						<i>Production Starch Equivalent required per 1 kg. Liveweight Gain</i>
<i>kg.</i>						<i>kg.</i>
under 250	..	..	..	..	..	1.5
250-450	..	..	..	..	..	2.0
over 450	..	..	.	..	..	2.5

NOTES ON FEEDING

Thus if a group of young cattle grazing an area increased in average liveweight from 250 kg. (550 lb.) to 400 kg. (880 lb.) in 200 days, the average liveweight gain per head would be 150 kg. (330 lb.) and the food (starch equivalent) consumed (apart from maintenance) to produce this would be estimated at $150 \times 2.0 = 300$ kg. (660 lb.). If now we take the maintenance requirement at 0.6 kg. starch equivalent per 100 kg. liveweight per day, then since the average liveweight over the 200 days is 325 kg. (715 lb.) the average daily maintenance requirement per head will be 3.25×0.6 kg., or 1.95 kg., and the total starch equivalent consumed for maintenance will work out at $1.95 \times 200 = 390$ kg. We thus arrive at an estimate of 690 kg., as the average food consumption (in terms of starch equivalent) per head for production and maintenance combined.

In order to turn this figure for starch equivalent into weight of actual produce we require to know the average starch equivalent value of the produce. If we assume, for example, that in this case the dry matter of the grass had a starch equivalent of 40 per cent., then the 690 kg. of starch equivalent would correspond to $\frac{690 \times 100}{40}$, or 1725 kg. of grass dry matter, or about four times this weight of fresh grass, since this usually contains 20-30 per cent. of dry matter.

The method is perhaps cumbrous, and based as yet upon inadequate data, but it represents at least an advance upon the comparison of grazing results merely upon liveweight changes, since these give no guidance as to the weights of food that have been required to give the changes recorded.

Food Requirements of Sheep. The discussion of this subject in last month's Notes requires now to be supplemented by reference to a further report from Oxford subsequently issued in the current number of the *Empire Journal of Experimental Agriculture*. In this report Professor J. A. Scott Watson and his colleagues summarize the results of six further feeding trials carried out in the years 1934-36. In each series the sheep were divided into three or four lots, and used for comparisons of different levels of food supply. In the various lots the food supply ranged from an estimated starch equivalent per head per week of 6.55 lb. to 13.51 lb., and the average liveweight increases per week recorded from 0.66 lb. to 3.27 lb. As the food supply was increased the

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ratio of additional starch equivalent consumed to additional liveweight gain produced remained relatively steady at an average of 1 : 0.227 or 4.4 : 1. In other words, the deduction may be drawn that a sheep, supposing that its energy requirements for maintenance, body-growth, and wool production are already met, requires about $4\frac{1}{2}$ lb. of starch equivalent for each pound of additional gain, and that this figure remains much the same as the level of nutrition is raised. It is interesting to note how closely this ratio approximates to the 4 : 1 ratio for the conversion of starch equivalent into pure body fat.

The data obtained in these experiments furnish further evidence in support of the Oxford contention that Wood's standard of 9 lb. starch equivalent per 100 lb. liveweight per week for the maintenance energy-requirement of the sheep is too high. In seven lots of sheep in the Oxford experiments here reported average liveweight increases of 0.66 lb. to 1.77 lb. were obtained, although the estimated starch equivalent consumed per 100 lb. liveweight was in no instance over 9.2 lb. and in one was as low as 6.9 lb. The conclusion is drawn, therefore, that, "at a rough guess" $6\frac{1}{2}$ or 7 lb. of starch equivalent per 100 lb. liveweight per week provided not only for maintenance but for normal growth, and 9 lb. per week provided for maintenance, growth, and the storage of fully half a pound of fat.

In view of the Cambridge pronouncement confirming the 9 lb. standard, there is clearly need for further and more precise investigation of this point.

In further discussion of the general formulation of food requirements the Oxford authors suggest that with growing animals the requirements for growth should be incorporated with the maintenance figure, rather than with the production figure as is customary.

On this basis, and from their experimental data, they suggest standards as given below for the fattening teg, 9 to 12 months old :—

<i>Per 100 lb. Liveweight</i>					<i>Starch Equivalent per Week</i>
Maintenance <i>plus</i> normal growth ($\frac{1}{2}$ lb. live-weight weekly)	..	..	..	..	6-7 lb.
Fat-production, per pound additional liveweight increase	..	..	..	..	4-4 $\frac{1}{2}$ lb.

The standards are also set out in the appended alternative

NOTES ON FEEDING

form which will perhaps be more convenient for practical application:—

<i>Tegs, 9-12 Months, per 100 lb Liveweight</i>				<i>Starch Equivalent</i>	
				<i>per Week</i>	
Normal growth	($\frac{1}{2}$ lb. per week)	..	..	6.5 lb.	
Slow fattening	(1 $\frac{1}{2}$ lb. " )	..	..	9.7 lb.	
Full fattening	(2 $\frac{1}{2}$ lb. " )	..	..	12.9 lb.	
Intensive fattening	(2 $\frac{3}{4}$ lb. " )	..	..	15.0 lb.	

It is pointed out that if the low Oxford maintenance standards, " or anything like them, can be confirmed by further work, they will put a different complexion upon one of the sheepfeeders' problems, viz. that of the relative economy of the fattening sheep at different levels of nutrition." The standards hitherto used lead to the conclusion that a satisfactory efficiency of utilization of food can only be attained by intensive feeding, but if the lower Oxford standards are correct the level of nutrition would appear to be relatively unimportant in this respect.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
Wheat, British	£ s. 10 0	£ s. 0 8	£ s. 9 12	72	s. d. 2 8	d. 1.43	% 9.6
Barley, British Feeding ..	8 15	0 8	8 7	71	2 4	1.25	6.2
" Argentine	9 0	0 8	8 12	71	2 5	1.29	6.2
" Persian	8 13	0 8	8 5	71	2 4	1.25	6.2
Oats, English, white ..	9 3	0 9	8 14	60	2 11	1.56	7.6
" " black							
and grey	9 3	0 9	8 14	60	2 11	1.56	7.6
" Scotch, white ..	9 13	0 9	9 4	60	3 1	1.65	7.6
" Canadian							
mixed feed	9 2	0 9	8 13	60	2 11	1.56	7.6
Maize, Argentine	6 15	0 7	6 8	78	1 8	0.89	7.6
" Gal. Fox.	6 17†	0 7	6 10	78	1 8	0.89	7.6
" South African ..							
No. 3, White Flat ..	7 8†	0 7	7 1	78	1 10	0.98	7.6
Beans, English, Winter ..	6 15§	0 17	5 18	66	1 9	0.94	19.7
Peas, English Blue	11 5§	0 15	10 10	69	3 1	1.65	18.1
" Japanese	22 17†	0 15	22 2	69	6 5	3.44	18.1
Dari	8 15†	0 8	8 7	74	2 3	1.20	7.2
Milling Offals :-							
Bran, British	7 12	0 16	6 16	43	3 2	1.70	9.9
" broad	8 2	0 16	7 6	43	3 5	1.83	10.0
Weatings†	8 7	0 14	7 13	56	2 9	1.47	10.7
" Superfine†	8 17	0 13	8 4	69	2 5	1.29	12.1
Pollards, imported ..	7 7	0 14	6 13	50	2 8	1.43	11.0
Meal, barley	10 0	0 8	9 12	71	2 8	1.43	6.2
" " grade II	9 5	0 8	8 17	71	2 6	1.34	6.2
" maize	7 7	0 7	7 0	78	1 10	0.98	7.6
" " germ	7 10	0 11	6 19	84	1 8	0.89	10.3
" locust bean	7 15	0 5	7 10	71	2 1	1.12	3.6
" bean	8 12	0 17	7 15	66	2 4	1.25	19.7
" fish (white)	14 15	2 2	12 13	59	4 3	2.28	53.0
" Soya bean							
(extracted)† ..	8 17	1 9	7 8	64	2 4	1.25	38.3
Maize, cooked, flaked ..	7 17	0 7	7 10	84	1 9	0.94	9.2
Linseed cake—							
English, 12% oil ..	10 5	1 0	9 5	74	2 6	1.34	24.6
" 9% "	9 12	1 0	8 12	74	2 4	1.25	24.6
" 8% "	9 7	1 0	8 7	74	2 3	1.20	24.6
Cottonseed cake,							
English, Egyptian ..							
seed, 4½% oil ..	6 2	0 18	5 4	42	2 6	1.34	17.3
Cottonseed cake,							
Egyptian 4½% oil ..	5 10	0 18	4 12	42	2 2	1.16	17.3
Cottonseed cake,							
decorticated, 7% oil ..	8 15†	1 8	7 7	68	2 2	1.16	34.7
Cottonseed meal,							
decorticated, 7% oil ..	8 12†	1 8	7 4	70	2 1	1.12	36.8
Coconut cake, 6% oil ..	7 5	0 18	6 7	77	1 8	0.89	16.4
Ground nut cake,							
decorticated, 6-7% oil ..	8 17§	1 8	7 9	73	2 0	1.07	41.3

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Ground nut cake, imported decorticated, 6-7% oil ..	8 2	1 8	6 14	73	1 10	0.98	41.3
Palm-kernel meal, 1-2% oil ..	8 2	0 12	7 10	71	2 1	1.12	16.5
Feeding treacle ..	5 0	0 8	4 12	51	1 10	0.98	2.7
Brewers' grains, dried ale porter ..	6 5	0 11	5 14	48	2 4	1.25	12.5
Brewers' grains, dried porter ..	5 17	0 11	5 6	48	2 2	1.16	12.5
Dried sugar-beet pulp ..	From £5 7s. 6d. to £6 2s. 6d. per ton ex factory (according to factory).						

§ At Hull.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE: The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of April 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 per ton as shown above, the cost of food value per ton is £10. Dividing this figure by 74, the starch equivalent of linseed cake as given in the Table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1.43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the Table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 3d.; P₂O₅, 2s. 3d.; K₂O, 3s. 6d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6·2	8 16
Maize	78	7·6	6 15
Decorticated ground-nut cake ..	73	41·3	8 9
“ cotton-seed cake ..	68	34·7	8 15
(Add 10s. per ton, in each instance, for carriage.)			

The cost per unit starch equivalent works out at 2·15 shillings, and per unit protein equivalent 0·81 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The Table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values,” which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent Per cent.	Protein equivalent Per cent.	Food Value per ton, on farm £ s.
Wheat	72	9·6	8 3
Oats	60	7·6	6 15
Barley	71	6·2	7 18
Potatoes	18	0·8	1 19
Swedes	7	0·7	0 16
Mangolds	7	0·4	0 15
Beans	66	19·7	7 18
Good meadow hay	37	4·6	4 3
Good oat straw	20	0·9	2 4
Good clover hay	38	7·0	4 7
Vetch and oat silage	13	1·6	1 9
Barley straw	23	0·7	2 10
Wheat straw	13	0·1	1 8
Bean straw	23	1·7	2 11

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d., post free 7d.

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The Agricultural Index Number

THE general index number of prices of agricultural produce for April is 140 (base 1911-13=100) or 10 points higher than a month earlier and 17 points above that ruling for April, 1936. (If allowance be made for payments under the Wheat Act, 1932, and the Cattle Industry (Emergency Provisions) Act, 1934, the revised index is 143.) Prices of wheat, barley, oats, fat cattle and sheep, potatoes and wool showed a rise, but those of fat pigs, eggs, butter and milk moved downwards.

Monthly index numbers of prices of Agricultural Produce. (Corresponding months of 1911-13 = 100.)

Month	1932	1933	1934	1935	1936	1937
January	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	140
May	115	102	112	111	115	—
June	111	100	110	111	116	—
July	106	101	114	114	117	—
August	105	105	119	113	119	—
September	104	107	119	120	127	—
October	100	107	114	113	125	—
November	101	109	114	113	125	—
December	103	110	113	114	126	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and the Cattle Industry (Emergency Provisions) Act (b)

Month	1932	1933	1934	1935	1936	1937
January	—	111	119	124	125	133
February	—	110	117	122	123	133
March	—	106	112	118	122	134
April	—	109	116	126	128	143
May	—	105	116	117	120	—
June	—	104	114	117	121	—
July	—	104	117	120	121	—
August	108	108	122	120	124	—
September	108	111	125	128	133	—
October	104	112	121	119	129	—
November	105	113	120	119	129	—
December	107	114	120	120	130	—

(a) Commenced August, 1932. (b) Commenced September, 1934.

Grain. Wheat, at an average of 9s. 11d. per cwt., was higher by 11d. per cwt. than in March, and the index moves

MISCELLANEOUS NOTES

upwards from 121 points to 131. Prices of both barley and oats rose by 3*d.* per cwt., the former averaging 10*s.* 1*d.* per cwt. and the latter 8*s.* 5*d.*, while the respective indices rise from 124 to 132 and 115 to 119. In April, 1936, wheat averaged 6*s.* 5*d.* per cwt., barley 7*s.* 4*d.* and oats 6*s.* 0*d.*, the relative indices being 85, 96 and 85.

Livestock. During the month under review, quotations for fat cattle continued to rise, the average for second quality at 38*s.* 9*d.* per live cwt. showing an increase on that of March of 2*s.* 9*d.*; the index at 106 is higher by 4 points. The effect of adding the subsidy under the Cattle Industry (Emergency Provisions) Act, 1934, brings the index up to 120. At an average of 1*s.* 0½*d.* per lb. for second quality, the price of fat sheep rose by ½*d.* per lb.; a reverse movement of a similar amount during the base period accentuates the rise in the index, which at 153 is 8 points above that recorded for March. Baconers at 11*s.* 11*d.* and porkers at 12*s.* 4*d.* per score (20 lb.) declined by 4*d.* and 9*d.* respectively, the relative indices at 119 and 117 being lower by 3 and 7 points.

Compared with March, dairy cows and store cattle were dearer; the index for the former rises from 111 to 112 points, and that for store cattle from 105 to 109. Store sheep also realised higher prices, the index moving from 117 to 128. On the other hand, store pigs were reduced in price and index, the latter showing a fall of 3 points to 126.

Dairy and Poultry Produce. The regional contract price of liquid milk was reduced by 1*d.* per gallon in April, but owing to the seasonal fall between March and April of the base years having been considerably larger than this amount, the latest index rises to 215 points.

Butter averaged 1*s.* 1¾*d.* per lb., a reduction of ½*d.* per lb., but here again, the decline which took place during the corresponding period of 1911-13 was heavier, and the index, as a consequence, rises from 100 to 104. Eggs at 8*s.* 6*d.* per 120 compared with 10*s.* 2*d.* per 120 in March; the index at 112 falls by 9 points. Quotations for cheese were not quite so high as a month earlier, and the average at £4 2*s.* 0*d.* per cwt. was reduced by 6*d.* per cwt.; the index falls by 1 point to 109. The combined index for poultry at 113 compares with 123 in March.

Other Commodities. At £8 13*s.* 6*d.* per ton, prices of potatoes were higher by 16*s.* 6*d.* per ton, but as a proportionately larger increase took place during the base years, the

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index at 191 shows a reduction of 9 points. Quotations for both descriptions of hay remained unchanged, although the combined index falls from 101 to 100 in consequence of a slight rise in the base prices. Wool averaged 1s. 5½d. per lb. or 1d. more than in March and the index advances by 8 points to 138.

Monthly index numbers of prices of individual commodities. (Corresponding months of 1911-13 = 100.)

Commodity	1935	1936	1937			
	Apr.	Apr.	Jan.	Feb.	Mar.	Apr.
Wheat	64	85	133	122	121	131
Barley	93	96	125	124	124	132
Oats	98	85	120	116	115	119
Fat cattle	86	92	97	99	102	106
„ sheep	141	128	140	137	145	153
Bacon pigs	108	111	130	126	122	119
Pork „	113	112	131	125	124	117
Eggs	96	107	95	115	121	112
Poultry	116	115	120	121	123	113
Milk	215	215	171	171	171	215
Butter	89	96	95	97	100	104
Cheese	91	100	107	107	110	109
Potatoes	95	164	205	201	200	191
Hay	99	79	98	98	101	100
Wool	83	97	131	131	130	138
Dairy cows	99	100	111	111	111	112
Store cattle	85	94	99	101	105	109
„ sheep	107	109	118	115	117	128
„ pigs	122	122	152	139	129	126

Revised index numbers due to payments under the Wheat Act and the Cattle Industry (Emergency Provisions) Act.

Wheat	114	120*	135*	134*	134*	131
Fat cattle	100	106	112	114	117	120
General Index	126	128	133	133	134	143

* Superseding figure previously published

Arrangements for Demonstrations to Parties of Farmers and others at Rothamsted and Woburn Experimental Stations

FARMERS and all interested in agriculture in its practical, technical, or educational aspects are cordially invited to visit the Rothamsted and Woburn plots at any convenient time from now to the end of October. Mr. H. V. Garner, M.A.

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(Camb.), and Capt. E. H. Gregory will be in charge of the demonstrations, and there is ample material at either of the farms to occupy a full day.

The soil at Rothamsted is a heavy loam. The classical fields, laid down from 1843 onwards, form an unequalled demonstration of the effects of fertilizers on wheat, barley, mangolds and meadow hay. The continuous growing of wheat on Broadbalk field is of special interest to those who are now faced with the manurial and cultivation problems arising out of mechanized cereal farming. Modern fertilizer and cultivation problems are being investigated by the new field technique developed at the Station.

These modern experiments are concerned with the manuring of potatoes, sugar-beet, wheat, barley, beans, mangolds, kale, clover and temporary grass. Rotation experiments test various alternative methods of returning cereal straw to the soil; and suitable equipment for the production of these manures is provided. In addition the effect of green manuring is being examined.

Additional experiments deal with poultry manure and other organic fertilizers, the effects of bare fallowing, and rotary cultivation. Tests of soil fumigants against insect and other pests are in progress. Experiments on various points of pig management are carried out from time to time. Good types of implements are on view at the farm and a complete electrical installation has been added. Growing trials on the effect of cake feeding on pasture are being started. If the weather turns out too bad to permit of inspection of the fields the results can be examined in the Demonstration Room.

The Woburn farm is on light soil. In addition to the classical fields, modern experiments are in progress on potatoes, barley, sugar-beet, kale, lucerne, pyrethrum and straw and green manure crops. It is not possible to see both Rothamsted and Woburn in one day.

The Director, Sir John Russell, will be happy to arrange full details with organizations of farmers, farm workers and others wishing to accept this invitation; small groups of farmers are specially welcomed.

All communications and requests to visit the Stations should be addressed to the Secretary, Rothamsted Experimental Station, Harpenden. It would be a convenience if ample notice could be given so as to avoid the possibility of dates clashing.

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Export of Breeding Stock

Number and declared value of animals, living, for breeding exported from the United Kingdom during 1936, with comparative figures for 1935. (From returns supplied by H.M. Customs and Excise.)

Country to which Consigned	1936		1935	
	Number	Declared Value	Number	Declared Value
<i>Cattle.</i>				
Australia	121	£ 13,633	52	£ 10,365
Canada	172	16,040	29	3,722
Irish Free State	210	7,548	216	5,683
Kenya	53	1,811	24	1,117
New Zealand	4	1,169	5	1,033
Union of South Africa ..	96	8,369	70	5,409
Southern Rhodesia ..	6	727	4	327
Newfoundland and Coast of Labrador	13	1,460	—	—
Other British Countries ..	34	1,859	20	1,235
Argentina	230	75,802	199	38,140
Brazil	30	1,657	47	2,225
Chile	1	118	8	524
Egypt	—	—	7	310
United States of America	51	3,860	32	2,935
Uruguay	23	5,356	11	1,788
Sweden	6	489	—	—
Denmark	5	95	—	—
Other Foreign Countries	7	150	7	275
TOTAL	1,062	140,143	731	75,088
<i>Sheep and Lambs.</i>				
Australia	75	2,533	53	2,332
Canada	163	2,648	74	1,822
Irish Free State	228	1,222	129	859
Kenya	27	389	6	109
Jamaica	—	—	12	82
Union of South Africa ..	69	904	148	2,171
New Zealand	14	286	2	120
Other British Countries ..	11	261	—	—
Argentina	387	10,928	393	13,815
Brazil	7	93	63	801
Chile	24	782	31	958
United States of America	20	207	—	—
Uruguay	15	386	97	3,470
Soviet Union	2,491	25,746	—	—
Finland	365	4,325	—	—
Poland	22	265	—	—
France	47	634	9	146
Madagascar and Dependencies	30	415	—	—
Other Foreign Countries	55	805	51	598
TOTAL	4,050	52,829	1,068	27,283

MISCELLANEOUS NOTES

Export of Breeding Stock—continued.

Country to which Consigned	1936		1935	
	Number	Declared Value	Number	Declared Value
<i>Swine.</i>		£		£
Australia	17	784	13	449
Canada	17	280	1	20
Channel Islands	130	240	56	108
Irish Free State	17	371	17	336
Malta and Gozo	20	300	32	686
Newfoundland and Coast of Labrador	—	—	13	55
Kenya	12	128	1	25
Union of South Africa ..	6	174	14	415
Other British Countries	11	192	10	150
Brazil	6	95	54	920
France	17	272	9	87
Germany	—	—	11	308
Japan	15	746	5	345
Switzerland	14	526	—	—
Hungary	—	—	39	834
Other Foreign Countries	39	1,105	30	698
TOTAL	321	5,213	305	5,436

Farm Workers' Minimum Rates of Wages.—A meeting of the Agricultural Wages Board was held at King's Buildings, Smith Square, London, S.W.1, on Tuesday, April 27, 1937, Mr. W. B. Yates, C.B.E., J.P., presiding.

The Board considered notifications from Agricultural Wages Committees, of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders :—

Beds and Hunts.—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor, to come into force on May 2, 1937, and to continue in operation until October 30, 1937. The minimum rates for male workers of 21 years of age and over are unchanged at 32s. 6d. per week of 50 hours, except (1) in the week in which Coronation Day falls when the hours are 41, with in addition not more than three hours in connexion with milking and the care of and attention to stock on that day, and (2) in the week in which Whit Monday falls when the hours are 41, with overtime throughout the period unchanged at 9½d. per hour on weekdays, 10½d. per hour on Whit Monday, and 11½d. per hour on Sundays and in addition 10½d. per hour on Coronation Day. The minimum rates for female workers of 18 years of age and over are unchanged at 6½d., with overtime at 7½d. per hour on weekdays, 8½d. per hour on Whit Monday, and 9½d. per hour on Sundays and in addition 8½d. per hour is payable for employment on Coronation Day.

Cumberland and Westmorland.—An Order fixing minimum and overtime rates of wages to come into operation on May 16, 1937 (i.e., the day following that on which the existing rates are due to expire), and to continue in force until June 4, 1938. The minimum rates are as follows :

MISCELLANEOUS NOTES

(a) for male workers of 21 years of age and over hired by the month or longer period, 41s. (instead of 40s. as formerly) per week of customary hours (which is defined as meaning a week of 62 hours); (b) for other whole-time male workers of similar age, 33s. (instead of 32s. as formerly) per week of 48 hours in winter and 34s. 6d. (instead of 33s. 6d. as formerly) per week of 54 hours in summer; (c) for casual male workers of 18 years of age and over, 8½d. per hour (instead of 8d. per hour as formerly); with overtime for all male workers of 18 years of age and over at 9d. per hour (instead of 8½d. per hour as formerly); and (d) for all female workers of 18 years of age and over 6d. per hour (instead of 5½d. per hour as formerly) for all time worked.

Durham.—An Order fixing minimum and overtime rates of wages to come into force on May 14, 1937 (the day following that on which the existing rates are due to expire) and to continue in operation until May 13, 1938. The minimum rates for male workers of 21 years of age and over are as follows: (a) horsemen who are householders, 34s. (instead of 33s. as formerly) per week of 50 hours, with, in addition, 7s. per week to cover all time spent in attention to horses; (b) horsemen who are not householders and are not boarded and/or lodged by their employers, 33s. (instead of 32s. as formerly) per week of 50 hours, with, in addition, 3s. 6d. to cover all time spent in attention to horses; (c) horsemen who are boarded and/or lodged by their employers, 33s. (instead of 32s. as formerly) per week of 50 hours and all time spent in attention to horses; (d) stockmen and shepherds, per week of the hours customarily spent in attention to stock, householders, 45s. (instead of 44s. as formerly), non-householders who are not boarded and/or lodged by their employers, 38s. 10½d. (instead of 37s. 10½d. as formerly), workers boarded and/or lodged by their employers, 37s. (instead of 36s. as formerly); (e) casual workers unchanged at 6d. per hour; and (f) for male workers, 32s. (instead of 31s. as formerly) per week of 50 hours. The overtime rates for all classes of male workers of 21 years of age and over (other than casual workers) remain at 9d. per hour, except for overtime employment on Saturday afternoon, Sunday, Christmas Day and Good Friday, when the rate is 10d. per hour. The minimum rates for female workers of 18 years of age and over are unchanged at 2s. 6d. per day of 8 hours, with overtime at 4d. per hour.

Gloucestershire.—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor to come into force on May 2, 1937, and to continue in operation until September 25, 1937. The minimum rates for male workers of 21 years of age and over are as follows: (a) head carters, 36s. 6d. per week of 58 hours, except in the weeks in which Coronation Day and Whit Monday fall when the hours are 51; (b) head shepherds and head stockmen, 38s. per week of 60 hours, except in the weeks in which Coronation Day and Whit Monday fall when the hours are 52½; (c) under-carters, 34s. 6d. per week of 54 hours, except in the weeks in which Coronation Day and Whit Monday fall when the hours are 48; (d) under-shepherds and under-stockmen, 36s. 6d. per week of 57 hours, except in the weeks in which Coronation Day and Whit Monday fall when the hours are 50½; and (e) other male workers, 32s. per week of 50 hours, except in the weeks in which Coronation Day and Whit Monday fall when the hours are 41. Provision is made for an adjustment of the hours in respect of which the minimum rate is payable in Coronation week to meet cases where a holiday is given in lieu of a holiday in the week in which Whit Monday falls. The overtime rates for all male workers of 21 years of age and over are unchanged at 9d. per hour on weekdays, and 11d. per hour on Sundays, Coronation Day and Whit Monday.

MISCELLANEOUS NOTES

Hertfordshire.—An Order varying the existing minimum and overtime rates of wages, the rates as varied to come into force on May 2, 1937, and to continue in operation until further notice. The minimum rates for male workers of 21 years of age and over are 34s. (instead of 32s. as formerly) per week of 48 hours, except (1) in the weeks in which Easter Monday and Whit Monday fall when the hours are 39½; (2) in the week in which Christmas Day and Boxing Day fall together when the hours are 31; and (3) in the weeks in which Christmas Day and Boxing Day fall when those days fall in separate weeks when the hours are 39½, with overtime at 8½d. per hour (instead of 8d. as formerly) for all employment on Easter Monday, Whit Monday, Christmas Day and Boxing Day, and in excess of the above-mentioned numbers of hours, and 11d. per hour (instead of 10d. as formerly) for all employment in excess of 5½ hours on Saturday or other agreed weekly short day. The minimum rates for female workers of 19 years of age and over are 28s. (instead of 25s. as formerly) per week of the numbers of hours mentioned above in the case of male workers, with overtime at 7d. per hour (instead of 6½d. as formerly) for all employment on Easter Monday, Whit Monday, Christmas Day and Boxing Day, and in excess of the above-mentioned numbers of hours, and 8½d. (instead of 7½d. as formerly) for all employment in excess of 5½ hours on Saturday or other agreed weekly short day. Special rates for overtime employment on the hay harvest are not fixed as formerly, but the rates for overtime employment on the corn harvest are for male workers of 21 years of age and over, 11d. per hour, and for female workers of 19 years of age and over, 8½d. per hour for all employment on harvest work during the corn harvest (after 5.30 p.m. legal summer time) on any day and in excess of 48 hours in any week.

Lancashire.—An Order fixing minimum and overtime rates of wages to come into force on May 1, 1937 (i.e., the day following that on which the existing rates are due to expire) and to continue in operation until April 30, 1938. The minimum rates for male workers of 21 years of age and over are (1) in the Southern area, workers employed wholly or mainly with animals (i.e., horses, cattle, sheep, pigs and poultry), 38s. (instead of 37s. for stockmen or teamsmen as formerly) per week of 52½ hours, and other workers, 34s. 6d. (instead of 33s. 6d. as formerly) per week of 50 hours; and (2) in the remainder of the area of the Committee, workers of the special classes mentioned above, 41s. (instead of 40s. for stockmen or teamsmen as formerly), and other workers, 38s. 6d. (instead of 37s. 6d. as formerly) per week of 60 hours in each case. The overtime rates for all classes of adult male workers are 9d. per hour on weekdays and 1s. 1½d. per hour on employment (other than time necessarily spent in the immediate care of and attention to animals) on Sundays. Overtime at 9d. per hour is also payable for employment (other than the immediate care of and attention to animals) on Christmas Day and Good Friday. For female workers of 18 years of age and over the minimum rate remains unchanged at 6d. per hour for all time worked.

Leicester and Rutland.—An Order varying the existing minimum and overtime rates of wages, the rates as varied to come into operation on May 2, 1937. The minimum rates for male workers of 21 years of age and over are (a) in Leicestershire, unchanged at 34s. per week of 54 hours, except (1) in the weeks in which Coronation Day, Whit Monday and Easter Monday fall when the hours are 48; (2) in the weeks in which Christmas Day and Boxing Day fall when those days fall in separate weeks when the hours are 48; and (3) in the week in which Christmas Day and Boxing Day fall together when the hours

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are 42 (instead of 54 hours per week throughout the year as formerly) ; and (b) in Rutland, unchanged at 32s. 6d. per week of 54 hours in summer, except in the weeks in which Coronation Day, Whit Monday and Easter Monday fall when the hours are 48, and 50 in winter, except (1) in the weeks in which Christmas Day and Boxing Day fall when those days fall in separate weeks when the hours are 44, and (2) in the week in which Christmas Day and Boxing Day fall together when the hours are 38 (instead of 54 hours per week throughout summer, and 50 hours per week throughout winter as formerly). The overtime rates in both counties remain unchanged at 9d. per hour on weekdays and 11d. per hour on Sundays. The minimum rates for female workers of 18 years of age and over remain unchanged at 5d. per hour, with overtime at 8d. per hour for Sunday work.

Norfolk.—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor, to come into force on May 2, 1937, and to continue in operation until December 25, 1937. The minimum rates for male workers of 21 years of age and over are unchanged at 33s. 6d. per week of 50 hours in summer, except in the week in which Coronation Day falls when the hours are 42, and 48 in winter, except in the week in which Christmas Day falls when the hours are 40, with, in addition in the case of workers employed as teamsmen, cowmen, shepherds or yardmen, 5s. 6d. per week, and in the case of sheep tenders and bullock tenders 4s. 6d. per week in lieu of overtime in respect of work in connexion with animals other than : (1) such work on Christmas Day, in respect of which an additional sum of 5s. is payable, except where a day's holiday with full pay is given in the week in which that holiday falls or in the week immediately following ; and (2) such work in excess of three hours on Coronation Day, in respect of which excess overtime is payable. The overtime rates for all male workers of 21 years of age and over are 9d. per hour on weekdays (including Coronation Day), and 11d. per hour on Sundays. The minimum rates for female workers of 18 years of age and over are unchanged at 5d. per hour, with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

Northamptonshire and Soke of Peterborough.—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor to come into force on May 2, 1937, and to continue in operation until October 30, 1937. The minimum rates for male workers of 21 years of age and over are unchanged at 32s. 6d. per week of 50 hours, except : (1) in the weeks in which Easter Monday and Whit Monday fall when the hours are 41 ; and (2) in the week in which Coronation Day falls when the hours are 41, with, in addition, not more than 3½ hours in connection with milking and the care of and attention to stock on that day. The overtime rates are unchanged at 10d. per hour on weekdays, 1s. per hour on Sundays, Easter Monday and Whit Monday, and in addition 1s. per hour is payable for employment on Coronation Day. The minimum rates for female workers of 18 years of age and over are unchanged at 6½d. per hour, with overtime of 7½d. per hour on weekdays and 9d. per hour on Sundays, Easter Monday and Whit Monday, in addition 9d. per hour is payable for employment on Coronation Day.

Oxfordshire.—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor to come into force on May 2, 1937, and to continue in operation until October 3, 1937. The minimum rates for male workers of 21 years of age and over are unchanged at 32s. 6d. per week of 50 hours, except : (1) in the week

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in which Coronation Day falls when the hours are 41, with, in addition, not more than three hours employment in milking and the care of and attention to stock on that day; and (2) in the weeks in which Whit Monday and August Bank Holiday fall when the hours are 41. The overtime rates are unchanged at 10*d.* per hour on weekdays, 1*s.* per hour on Sundays, Whit Monday and August Bank Holiday, and in addition 1*s.* per hour is payable for employment on Coronation Day. The minimum rates for female workers of 18 years of age and over are 6½*d.* per hour, with overtime at 8*d.* per hour on weekdays, and 9½*d.* per hour on Sundays, Whit Monday and August Bank Holiday, and 9½*d.* per hour on Coronation Day.

Suffolk.—An Order cancelling the existing minimum and overtime rates for male workers and fixing fresh rates in substitution thereof to come into force on May 2, 1937, and to continue in operation until August 28, 1937. The minimum rates for male workers of 21 years of age and over are unchanged at 31*s.* 6*d.* per week of 50 hours, except in the week in which Coronation Day falls when the hours are 41½, with, in addition, in the case of horsemen, cowmen and shepherds of 18 years of age and over, a sum of 6*s.* per week to cover employment up to 10 hours per week in connexion with the immediate care of animals. The overtime rate for all male workers of 21 years of age and over remains at 9*d.* per hour.

Warwickshire.—An Order varying the existing minimum and overtime rates of wages, the rates as varied to come into force on May 2, 1937. The minimum rates for male workers of 21 years of age and over are 32*s.* (instead of 31*s.* as formerly) per week of 50 hours in summer, except in the weeks in which Good Friday and Coronation Day fall when the hours are 41, and 48 hours in winter, except in the week when Christmas Day falls, when the hours are 39½. The overtime rates are 9*d.* per hour on weekdays and 10*d.* per hour on Sundays, Good Friday, Christmas Day and Coronation Day (instead of 8½*d.* per hour as formerly). Provision is made for an adjustment of the hours in respect of which the minimum weekly wage is payable in the weeks in which Easter Monday and Boxing Day fall to meet cases where holidays are given in those weeks instead of in the weeks in which Good Friday and Christmas Day fall. For female workers of 18 years of age and over the minimum rates are unchanged at 5*d.* per hour, with overtime at 6*d.* per hour on weekdays and 7½*d.* per hour on Sundays, Good Friday and Christmas Day, in addition 7½*d.* per hour is payable for employment on Coronation Day.

Merioneth and Montgomery.—An Order fixing minimum and overtime rates of wages to come into force on May 1, 1937 (i.e., the day following that on which the existing rates are due to expire), and to continue in operation until April 30, 1938. The minimum rate for male workers of 21 years of age and over employed wholly or mainly as stockmen, teamsters, carters, or shepherds, is 34*s.* per week of 60 hours (instead of 32*s.* 6*d.* per week of 58 hours as formerly), and that for other male workers of 21 years of age and over is 30*s.* per week of 54 hours (instead of 28*s.* 6*d.* per week of 52 hours as formerly), with overtime in each case unchanged at 9*d.* per hour. For female workers of 18 years of age and over the minimum rate remains unchanged at 5*d.* for all time worked.

Enforcement of Minimum Rates of Wages.—During the month ending May 10, 1937, legal proceedings were taken against six employers for

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failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow :—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers involved
Cornwall ..	Helston ..	£ s. d. 4 0 0	£ s. d. 1 1 0	£ s. d. 15 16 5	2
Lincs. (Kest-even and Lindsey)	Market Rasen	4 5 0	—	60 0 0	9
Monmouth ..	Raglan ..	0 18 0	—	6 0 0	1
Norfolk ..	Downham Market	0 13 0	0 7 6	52 9 5	3
Suffolk ..	Stowmarket	(a)	4 2 0	30 4 4	2
Radnor ..	New Radnor	0 11 0	—	20 0 0	1
		10 7 0	5 10 6	184 10 2	18

(a) Dismissed under Probation of Offenders Act.

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AGRICULTURAL

Station and Date	Time : p.m.	Speaker	Subject
National :			
June 7	6.20	Mr J. G Stewart	Haymaking.
" 14	6.20	Messrs. J. G Stewart and Ross Woodley	The Law relating to Boundaries and Trespass
" 21	6.20	Mr. J. G. Stewart	Weeds.
" 28	6.20	Messrs. W. S. Mansfield and J. G Stewart	Farm Horses
West :			
June 2	5.30	Mr. A. W. Ling	Down on the Farm (Children's Hour)
" 17	6.40	Mr. A W Ling	For Western Farmers in particular.
North :			
June 17	9.45	Messrs. T. Taylor, J. A. Willis, F. Barker and R. H. Lamb.	A Discussion about Sheep.
Welsh :			
June 4	7.55	Professor Isaac Jones and Mr. W. H. Jones	How a Welsh Farm Institute Works.
" 5	7.30	Mr. David Thomas	Farm and Animal Calls
" 18	—	Discussion between Messrs. W. H. Jones, Percy George, and E. G. Bowen	Rural Industries in Wales To-day (in English).
Scottish :			
June 3	7.30	Mr. J. P. Ross Taylor	Rural Housing.
" 10	6.25	Not yet arranged	Prospects of the Highland Show.
" 17	6.0	Lord Cochrane of Cults interviewed by Mr. A. D. Buchanan Smith	New Methods at Cults.
" 22	8.50	Mr. J. B. Douglas	At the Highland Show (1).
" 23	10.25	Mr. J. B. Douglas	At the Highland Show (2).

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HORTICULTURAL

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker and Subject</i>
National :		
Fridays :		
June 4	7.10	Interesting Plants: Messrs. C. H. Middleton and N. K. Gould.
" 11	7.10	Seasonal Topics: Mr. C. H. Middleton.
" 18	7.10	Roses: Messrs. C. H. Middleton and Courtney Page.
" 25	7.10	Mr. C. H. Middleton discusses gardening problems with an amateur.
West :		
June 20	—	For Western Gardeners: Plant hybridization for amateurs: Messrs. D. Harris and C. F. Langdon.
Scottish :		
June 1	6.15	June in the Garden (1): Mr. Alexander Keith.
" 14	9.0	" " " (2) " "
North :		
June 4	—	Mr. W. E. Shewell-Cooper will describe his correspondence bag, pick out typical letters from readers in all parts of the North and give his replies.
" 18	—	Messrs. W. L. Steer and W. E. Shewell-Cooper will give a talk on " Winter Produce for the Vegetable Garden."
Northern Ireland :		
June 9	—	Ulster Garden: Mr H. G. Fleet.
" 23	—	" " " "

Foot-and-Mouth Disease.—No outbreak of Foot-and-Mouth Disease has been confirmed since February 5. At the time this issue of the JOURNAL went to press, no part of Great Britain was subject to any restriction in connexion with this disease.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Cheshire: Mr. W. L. Steer has been appointed Horticultural Superintendent, *vice* Mr. H. Fairbank, N.D.H.

Derbyshire: Mr. B. K. Randall, N.D.H., has been appointed Assistant Horticultural Instructor.

NOTICES OF BOOKS

The National Farmers' Union Year Book, 1937. Edited by Cleveland Fyfe Pp. 522. (London: National Farmers' Union. Price 5s.)

The sixteenth issue of this well-known annual publication as usual contains a large number of useful facts and figures for farmers and others who are interested in agricultural matters. An article by Sir John Orr deals with "The Science of Nutrition and Agricultural Policy," a subject that has aroused great interest in recent years. A chapter entitled "Legislation Affecting Agriculture in 1936," summarizes the Tithe Act, the Education Act, the Sugar Industry (Reorganization) Act, the Unemployment Insurance (Agriculture) Act and other important additions to

NOTICES OF BOOKS

the Statute Book during last year. Other chapters are entitled "The Marketing Schemes of 1936," "The Farmers' Statistical Abstract"—compendious and up-to-date, "A Transport Miscellany" and "Fertilizers and Feeding Stuffs." All the information in this useful annual is made readily accessible by means of a comprehensive index.

Journal of the Bath and West and Southern Counties Society. Vol. XI, 1936-37. Pp. ciii + 148. Illustrated. (London: Edward Stanford, Ltd. Price 6s. 6d.)

Agriculture in the West Country is well represented by this long-established annual, the present issue of which covers a wide and varied range of interests. Grass drying, which is engaging much attention at the moment, forms the subject of an article by the Earl Waldegrave and Mr. W. T. Price. Mr. J. F. H. Thomas writes on "Causes of Loss in Sheep," and Mr. R. W. Marsh contributes "Notes on Apple Canker." Other articles deal with pit props, forestry, a survey of soils and fruit in the Vale of Evesham, dormant roots and buds of the cricket-bat willow, the effects of the removal and retention of lateral branches in the production of sets of the cricket-bat willow, *Anguillulina Dipsaci* as a cause of parsnip canker, experiments on the control of lichen on apple trees by means of tar-oil washes, control of insect pests of nursery fruit stock, the effect of nitrogenous fertilizers on potatoes affected with potato sickness, and fruit spraying. In addition there are reports and full information regarding the Bath and West and Southern Counties Society, now in its 161st year.

Agricultural Progress. Vol. XIV (Part. I): 1937. Pp. 94. (Cambridge: W. Heffer & Sons, Ltd. Price 2s.)

The publication of the official organ of the Agricultural Education Association in parts is a new departure. The opening article in this part is an interesting account by Sir E. John Russell of the origin and development of the Rothamsted Experimental Station, the first of a series dealing with the history of the agricultural educational and research institutions of the United Kingdom. This is followed by papers on land reclamation in Scotland, the agriculture of South-Western Scotland, the Ayrshire early potato industry, bracken eradication, mastitis, milk in cheese-making, cacao shell as a foodstuff for cattle, ice-cream, insects associated with bracken, and chicken rearing for egg production, each by well-known writers on their respective subjects. The issue concludes with a record of recent activities, book reviews and information concerning the Association.

The Feeding of Crops and Stock: Part I—The Plant. 2nd edition. By Sir A. Daniel Hall, K.C.B., F.R.S. Pp. ix + 120 and 18 Figs. (London: John Murray. 1937. Price 3s. 6d.)

This is an old friend in a new guise! In its original form it was published in 1911. It acquired immediate and widespread popularity, and frequent reprints of this edition were called for in the years that followed. The author has now deemed it desirable, in view of the great strides made by biological science during the last twenty-five years, to revise and re-write a considerable part of the subject-matter and to divide the treatise into three distinct parts. The volume under review constitutes Part I and deals with plant growth generally, the functions of the leaf and the roots, the changes of composition that take place within the plant throughout growth, and the subject of reproduction in the plant world. A particular feature of this new edition, compared with the former version, is that the arguments and illustrations have been drawn as freely from horticulture as from agriculture, and the work gains thereby in interest and usefulness.

NOTICES OF BOOKS

Sir Daniel Hall needs no introduction to agricultural readers. His attractive style of writing, and the ease with which he brings the most difficult subject within the range of understanding of all classes of readers, have placed him securely in the foremost rank of writers on agriculture. The present volume will be read with pleasure and profit by all who are interested in the growth of crops on the farm or in the routine of the garden. It calls for no special scientific training in the reader. Indeed, Sir Daniel expresses the hope that the complete treatise will find its way into the schools and furnish to the youthful mind a guide to the appreciation of the major processes by which life is carried on and our food is produced.

"What I have tried to do," writes the author, "is to provide the non-technical reader with a scientific approach to the understanding of how life is carried on." Those who are familiar with his long record of literary and scientific achievement will agree that no one is more competent than Sir Daniel Hall to undertake this difficult and fascinating task!

Grass-Drying : A Study of Production Costs in 1936. By R. N. Dixey and R. P. Askew. Pp. 45. (Oxford: Agricultural Economics Research Institute. 1937. Price 1s.)

This small book is another addition to the rapidly-growing literature of grass-drying. Its appearance is one further proof of the general interest aroused by this new farm process. Whether grass-drying has come to stay or not, it cannot be denied that the investigations of Woodman and his colleagues have stimulated agricultural inquiry on a scale that can scarcely be paralleled by any other discovery of recent times.

The authors rightly point out that the commercial success of the process must depend on whether the dried young grass can be produced at a cost to compete with the feeding stuffs it is designed to replace. With the object of gaining an insight into the economics of the problem, they selected, in the South Midlands, five farms, on which costings investigations could conveniently be carried out. Large Billingham driers had been installed on three of these farms, while on the remaining two were Ransome and Curtis-Hatherop driers respectively.

The writers give exceedingly interesting and readable accounts of the season's experiences on these five farms. It is, in the main, a story of difficulties encountered and only partly overcome. The treatment of the grass, the cutting and delivering of the grass to the drier, the processes of drying, baling and storing are all dealt with in detail. It is shown that the inclusive cost per ton of dried grass produced on the selected farms averaged £5 18s. 6d.

It may be observed that if the dried grass produced on these farms was the genuine "concentrate" product, then the cost was not really uneconomic, since on the basis of the present prices of feeding stuffs, dried young grass is worth at least £6 per ton for its digestible protein and starch equivalent, without taking into account the unassessable factors of minerals, pigments and vitamins. Reference to the figures given for protein content, however, shows that the product obtained was not of the highest grade. This was due to the circumstance that the herbage, under the influence of the heavy summer rainfall, was usually "ahead" of the drier. The area of grass to be cut must clearly be adjusted to the rate of output of the drying appliance.

It is perhaps futile to speculate about the costings of grass-drying until the right machine has been designed and the correct field technique developed. For this reason the authors may agree that the findings from their 1936 investigation should not be taken too seriously. It is sincerely to be hoped, however, that their researches in this direction will be continued.

NOTICES OF BOOKS

Chemistry of Food and Nutrition. By H. C. Sherman, Ph.D., Sc.D. 5th edition. Pp. x + 640. 38 Figs. and 64 Tables. (London: Macmillan & Co. 1937. Price 12s. 6d.)

This American textbook, which is well known to British students of the biochemical aspects of human nutrition, was first published in 1911. For the purposes of this, the fifth edition, it has been completely revised and re-written, a course that was dictated by the great advances that have been made in the chemistry of food and nutrition during the last quarter of a century. The result has been to provide teacher and student with a textbook embodying the findings of all the main nutritional researches of recent times. In its pages are expounded the most modern views of the relation of nutrition to the general well-being of the human organism.

The keynote to the significance of this treatise is furnished by the author in the preface. "The present work," he writes, "is published primarily to meet the needs of college classes. It is hoped that the book may also be of service to other readers who appreciate the importance of food and nutrition as factors in health." It follows, therefore, that the volume may be perused with profit by those authorities in this country who are advocating an improved general standard of nutrition as a basis for a higher standard of health and physique among the British races.

The author rightly emphasizes the importance of a well-balanced knowledge of all the four main factors of nutritive requirement—energy, protein, mineral elements and vitamins. His treatment of the subject is indeed built up around this central idea. The chapters dealing with these factors leave little to be desired, and taken together, they form a comprehensive and satisfying picture of the present state of knowledge in this crucial branch of biological inquiry.

Not the least valuable features of the book are the lists of references at the ends of the chapters, and the tables in the appendix giving the organic and mineral composition, together with details of vitamin content, of all the common foods that make up the human dietary. Although the volume deals specifically with the science of human nutrition, an understanding of the principles belonging to this branch of nutrition makes possible a fuller appreciation of the factors underlying the successful feeding of farm animals. The discerning student of animal nutrition, therefore, will not hesitate to acquire this admirable new edition of Professor Sherman's work.

A Practical Course in Agricultural Chemistry. By F. Knowles, F.I.C., and J. E. Watkin, B.Sc., Ph.D., A.I.C. Introduction by Sir John Russell. Pp. x + 188, and 21 Figs. (London: Macmillan & Co., Ltd. 1937. Price 10s.)

This volume can truly be said to have filled a long-felt want. This is at once the pleasantest and the rarest compliment that can be paid to the author of a new textbook in these days of busy printing-presses.

For one reason or another, the claims of the agricultural chemist to a concise and systematic account of analytical methods have in the past received but scant recognition. Who, among old students of the subject, does not remember the typed sheets of instructions that used to be issued as a guide to chemical work in the laboratory? How impermanent were these sheets, their life being scarcely longer than the few short terms during which the laboratory exercises were being carried out!

Gone is now the need for the laboratory typescript, for in the volume under review we have a practical textbook that will be welcomed by all teachers of practical agricultural chemistry. In the words of the authors, it has been produced to meet the requirements of students preparing for

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the B.Sc. degrees in agriculture, horticulture and dairying, for the national and college diplomas in these subjects and in poultry husbandry. It brings together a considerable amount of material at present only accessible in scientific journals, specialized books and miscellaneous publications.

By virtue of their long experience in the teaching of the subject, the authors have been able to use their discretion in discarding obsolete methods and views. They have set out to write a thoroughly up-to-date and reliable textbook, and in this object they have succeeded in the fullest sense. The wide scope of the treatment is revealed in the titles of the main chapters, which deal with the analytical methods employed in the chemical examination of soils, fertilizers, feeding stuffs, dairy products, water, insecticides and fungicides.

In an admirable foreword, Sir John Russell calls attention to a specially valuable feature, namely, that explanations are given not merely of the processes performed, but of the relation of the experiment to the whole subject, so that the student may be able to appreciate the bearing of his laboratory exercises on farm practice. No student of agricultural science should be without this textbook.

Second International Congress for Microbiology, London, 1936. Report of Proceedings. Edited by R. St. John-Brooks. Pp. xiii + 579. Illustrated. (London: Harrison & Sons, Ltd. 1937. Price 20s.)

This volume, as its title indicates, gives a full account, in not far short of 600 pages, of the activities of, and the scientific work presented to, the Congress for Microbiology held in London from July 25 to August 1, 1936, under the Patronage of H.R.H. The Duke of Kent and the Presidency of Professor J. C. G. Ledingham, of the Lister Institute. Abstracts of the proceedings of the eight Sections in which the work of the Congress was carried on make up the greater part of the volume. The Presidential Address and those by the Presidents of Honour are also included. That of Sir John MacFadyean may perhaps be specially mentioned here since it deals with the progress that has been made in our knowledge of, and power to control, contagious diseases of domestic animals during a period of nearly half a century. Whilst in nearly all the Sections papers on matters of fundamental biological importance having some relation to agricultural science were read and discussed, yet the accounts of the proceedings in Section 2 (Viruses and Virus Diseases in Animals and Plants), Sub-section 1 of Section 4 (Dairy Microbiology), and Section 5 (Medical, Veterinary and Agricultural Zoology and Parasitology), will perhaps be of more immediate interest to those engaged in research in agriculture. Virus workers will be interested in Dr. P. R. White's method of cultivating plant viruses indefinitely *in vitro* on isolated plant organs under controlled conditions (p. 71), as also in Dr. W. M. Stanley's crystalline Tobacco Mosaic protein (p. 82), a specimen of which was exhibited.

The dairy bacteriologist will read with interest the reports of the discussions on the significance of the number and types of bacteria in milk (p. 183), and on the factors that determine the behaviour of micro-organisms in milk and milk products (p. 194). Other papers and discussions, e.g. those on the decomposition of plant-remains in soil, manure and compost heaps (p. 223), on the microbiology of silage production (p. 231), and on the physiology of nitrogen-fixing organisms and the biochemistry of nitrogen fixation (p. 261) are of special interest to soil research workers. To plant physiologists the papers and discussion on bacterial photo-synthesis (p. 465) will appeal, whilst those on the prophylaxis and serum treatment of human and animal diseases caused by anaerobic bacteria will be of particular interest to the veterinarian. The above are merely a few selections from the vast amount of scientific work

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on microbiology, in all its varied aspects, which was brought before the Congress and is so successfully garnered into the present volume. The Editor is to be congratulated on having produced with commendable promptitude a worthy record of this important Congress, for permanent reference.

Journal of the British Dairy Farmers' Association. Vol. XLIX. Pp. 442. (London: British Dairy Farmers' Association. 1937. Price 6s.)

A glance at the names of the contributors to this well-known annual assures us that we shall find in it reliable and up-to-date information on the subjects with which they deal. The first paper, by Messrs. Edgar Thomas and F. H. Villiers of Reading, provides some useful practical lessons from "Grassland Dairying in the Blackmore Vale" and has been reprinted in pamphlet form. Evidence is presented concerning the financial results on ten dairy farms during a four-year period, the general conclusion being that the most important single factor in the success or failure of these dairy farmers is their ability to make economical use of their chief raw material, viz., their grasslands. Mr. H. G. Robinson (Principal, Midland Agricultural College, Sutton Bonington) writes on "Dairying in Derbyshire, Leicestershire and Nottinghamshire," Dr. A. T. R. Mattick (National Institute for Research in Dairying) on "Applied Bacteriology in Dairying" and Mr. E. Walker on "Dairy Changes in Village Life," and Mr. E. E. F. Colam contributes "Some Remarks on Ice-Cream." In addition to the usual reports and information concerning the Association, there are papers on butter tests, poultry and pigeons, and a detailed review by Mr. T. W. Palmer on milking trials for goats in 1936.

The Social History of American Agriculture. By Joseph Schafer, Ph.D., LL.D. Pp. viii + 302, and 9 Maps. (London: Macmillan & Co., Ltd., 1936. Price 10s. 6d.)

The essays that comprise this study were first delivered at University College, London, in the early part of last year. In preparation for publication they have been extended, and documentary evidence has been provided. The development of agriculture since the coming of the white man to America has successively taken on very varied phases, with consequent reactions upon the lives of the people engaged in the farming. In the short space of three hundred years a continent has been subdued, and it has, in some respects, reached the highest point of development in agriculture of any country in the world. Many and varied are the lessons that the countries of the older civilization in Europe have learned from their young relation.

Schafer's book tells the story clearly and concisely. Beginning with the planting of Virginia and the settling of the Pilgrim Fathers at New Plymouth, he brings the story down to modern times, when farming in America has become as disastrous for many people as it has in the older countries since the Great War. The gradual spread westward of the white man, the assimilation of the public domain, the varieties of farming that became necessary as each new strip of territory was occupied, will be not only fascinating to the farmer, but instructive to the layman, since they show how methods of exploiting land are restricted by its configuration, soil, and climate. There is no such similar study of British conditions, although there are many books that touch upon the subject. For this reason students of the history of agriculture should read this work, which they will find suggestive of new and interesting lines of inquiry.

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"The Feathered World" Yearbook, 1937. Pp. 300. Illus. (London : *The Feathered World*, 9, Arundel Street, W.C.2. Price 2s.)

This issue of a useful annual well maintains its normal standard. It contains articles dealing with all breeds of poultry, pigeons, ducks, geese and cage-birds, and there is an attractive illustrated supplement showing prize-winning birds of the year. The section on poultry organization provides information concerning the poultry press, poultry personalities and societies, and lists of county poultry instructors for England, Scotland, Wales and the Irish Free State, but, strangely enough, no mention is made of the very capable group of instructors who serve the industry in Northern Ireland.

Great Farmers. By Professor J. A. Scott Watson and May Elliot Hobbs. Foreword by the Rt. Hon. Walter Elliot. Pp. 287. Illus. (London : Selwyn & Blount. 1937. Price 12s. 6d.)

It is not too much to say that the land of England has been made in the past two centuries, and many of those eminent men who led in the task lived and died in comparative obscurity, except amongst the agricultural community, which took example from their activities and precepts. Professor Scott Watson and Miss Hobbs have rescued many of them from this undeserved obscurity in what is a fascinating tale of endeavour and achievement. The moral to be drawn from this entertaining book is that the course of farming improvement is necessarily slow, and that a final outstanding result can only be secured by a tenacity of purpose that is often condemned by the urban population as the stubbornness of the farmer.

Growth processes are slow and the making of new varieties of plants needs years to bring them to maturity. With animals the creation of a great herd or an outstanding flock is a matter of an even longer period. In one or two of the instances described in this book it took three generations of men to bring intractable areas of land into a state of high cultivation and prosperity. In others, one man's lifetime was sufficient to secure fame and financial recompense for years of striving. The book should be widely read and should undoubtedly lead our predominantly urban population to a better understanding of the problems that farming and rural life present.

The Production of Field Crops : A Textbook of Agronomy. By T. B. Hutcheson, T. K. Wolfe and M. S. Kipps. Pp. xvii + 445, and 110 figs. (London : McGraw-Hill Publishing Co., Ltd. 1936. Price 21s.)

The writer of a text-book on the field crops (of North America) must be under the same disadvantage as one who proposed to perform the same task for the continent of Europe. Clearly what is given to breadth of treatment takes away from depth. This is a text-book in the sense that it provides an arrangement of the subject and lecture headings for the instructor, who is left to select material according to his territory and supplement it from his local knowledge; and that is the extent of its claim. It is apparently suitable for North American conditions and cropping, and may be regarded as having reached a high standard. The work may have an interest for British readers, but has little or no bearing on British agriculture.

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Research on Foot-and-Mouth Disease

The following note has been contributed by Sir Joseph Arkwright, F.R.S., of the Lister Institute of Preventive Medicine, who is Chairman of the Foot-and-Mouth Disease Research Committee of the Ministry:—

The fifth Progress Report of the Foot-and-Mouth Disease Research Committee of the Ministry of Agriculture and Fisheries, recently issued, covers the work of about five years.

It contains a brief review of the past work and aims of the Committee and a general summary of the more recent results from the experiments recorded in detail in Appendices to the Report. The research has been carried out at the Pirbright Experimental Station where farm animals have been used, at the National Institute for Medical Research, Hampstead, the Lister Institute, Chelsea, and for a part of the time at Manchester University and at the Oxford Bureau of Animal Population.

Numerous lines of research have been followed, but they can be grouped under three main headings:— (a) inquiry into the properties and behaviour of the virus, (b) the means whereby infection is introduced and spread, and (c) problems connected with resistance to the disease.

These subjects have been investigated from many different aspects and considerable progress has been made.

A close examination of the infective agent or virus and the minute particles of which it is composed shows that these latter are smaller than almost any other known microbes and are about two-millionths of an inch in diameter. Their size and the very large number present in infective material probably account for the very high infectivity of this disease. After many trials of different disinfectants it has been found that washing soda is the most efficient means of destroying the virus outside the animal body, besides being cheap and easily obtained. Study of the properties of the virus has shown its

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general resemblance to the viruses of other infective diseases and has also provided means of distinguishing between Foot-and-Mouth disease and certain other diseases, such as vesicular stomatitis of the horse.

Many kinds of animals, including rats, rabbits, mice, dogs and cats, can be infected artificially, but there is little evidence that most of them acquire the disease naturally and pass it on to others, though no doubt they can act as mechanical carriers. Hedgehogs alone besides cattle and other hooved animals are readily infected by contact and able to transmit the disease to other susceptible individuals. There is no proof, however, that in nature wild hedgehogs contract the disease and transmit it to farm animals. Since the hedgehog so nearly resembles cattle in relation to this disease, it is hoped that further use can be made of this animal to advance knowledge of the natural methods of infection and of procuring immunity.

One of the chief aims of the Committee's work has been to discover any means by which farm animals can be made more resistant to Foot-and-Mouth disease, and during the last few years experiments with cattle have been made on a larger scale than before; the experimental work has previously been largely carried out with guinea pigs and rats, which, though cheap, easily handled, and invaluable for many purposes, do not quite reproduce the disease as seen in farm animals. The ease with which animals can be infected and the severity of the attack vary very much with the age and state of nutrition, and under some circumstances ill-fed and old animals suffer less than those in better condition; moreover, this observation seems to be applicable to several different species.

Experiments on the protection afforded by vaccine or serum have been very much complicated by the discovery that there are several types of virus, all causing apparently identical forms of illness; but an attack due to one type does not protect against the other types. It has been found that one attack gives a more lasting immunity against infection with the same type than was formerly supposed.

These experiences encourage the hope that in spite of the great difficulties encountered a practical vaccine may eventually be obtained. One of the chief hindrances to preparing a vaccine consists in the difficulty in obtaining a sufficient supply of highly active virus. If a good and easy method of protective vaccination were discovered perhaps the

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chief value for this country would be the reduction of disease in those other countries with which the British Isles are connected through the meat trade.

The means whereby the disease is introduced into this country can seldom be ascertained, but it is known that chilled and frozen meat and bones may remain infective for many weeks. The Ministry has therefore ordered that uncooked meat, bones and offals must not come in contact with farm animals, and an Order also prohibits the use of wrappers from imported carcasses in connexion with farm animals or for making bags to contain fodder for animals. These very important regulations, in addition to the other means of administrative control, are calculated further to diminish the risks of outbreaks.

The Animal Diseases Research Association.

The following note has been received from the Agricultural Research Council:—

An extensive programme of investigation into the cause and prevention of disease in farm animals confronts the Animal Diseases Research Association, whose Institute, situated at Moredun, near Edinburgh, is under the direction of Dr. J. Russell Greig, M.R.C.V.S.

It has for some time become apparent that the existing laboratories and animal accommodation at Moredun were insufficient for the Research Association's rapidly extending work, and Treasury sanction has recently been given to the recommendation of the Agricultural Research Council and the Department of Agriculture for Scotland that a grant not exceeding £9,800 should be made available (after taking into account any receipts from other sources) from the Development Fund to enable necessary building extensions to be undertaken. Further, the permanent staff of the Institute will be strengthened by the additional appointment of a senior and a junior research officer, with a full complement of laboratory assistants.

In view of the economic importance of grass sickness, it became clear to the Department of Agriculture for Scotland and the Agricultural Research Council that further extension and intensification of the research into the cause and prevention of this disease were necessary. Besides the capital sum already mentioned, which was approved on exceptional terms in order that the needs of the grass sickness investigations might be met immediately, the Treasury have sanctioned an appropriation

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from the Development Fund to the Department of Agriculture for Scotland of such sum not exceeding £3,200 as, after taking into account any funds provided from other sources, might be required by Moredun Institute to meet the expenditure for extended work on this disease during the current financial year. Several contributions towards the cost of grass sickness investigation have been received from outside sources, notably that from the Racecourse Betting Control Board, who have granted £1,000 for the work on grass sickness at Moredun during 1937.

The granting of these additional sums will make it possible to test on a large scale in the field the value of vaccination of horses against infection with grass sickness. For this purpose additional temporary veterinary appointments have been made. It should be clearly realized, however, that while the cause of this fatal disease which is reported to have killed some 1,200 to 1,500 horses last summer and is by no means confined to Scotland, is suspected to be due to poisoning developed in the intestine by certain bacteria, taken in on grass or in some other way during feeding, this theory, though promising, is not yet proved. The vaccination trial, which is being made after careful preliminary experiment, is intended as a further test of this theory.

Meat

THE Imperial Economic Committee has recently published a useful summary of the figures relating to world production of and trade in meat.* The figures relate to the period 1929-1935, but there are appendices on "Regulation of Meat Imports into the United Kingdom" and on "Meat Duties and Quantitative Restrictions in Foreign Importing Countries," in which the information, in some instances, also relates to 1936.

Perhaps the most interesting section of the publication is that dealing with the increasing share of home production in the total meat supplies of the United Kingdom. In the 7 years under review, the output of beef and veal in the United Kingdom increased by over 1 million cwt. and comprised 52 per cent. of the imports requirements in 1935, as against 48 per cent. in 1929. The home production of mutton and lamb declined from 46 per cent. to 43 per cent. of total

* *Meat: A Summary of Figures of Production and Trade relating to Beef, Mutton and Lamb, Bacon and Hams, Pork, Cattle, Sheep, Pigs and Canned Meat.* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. Price 2s 6d, post free 2s. 9d.

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supplies. In the same period, the output of pig meat is estimated to have increased by no less than $2\frac{1}{4}$ million cwt., and to have accounted for almost exactly one-half of the United Kingdom consumption of pig meat in 1935, compared with 39 per cent. in 1929.

In addition to the expansion in home production, Empire countries are providing an increasing share of United Kingdom meat requirements. The Empire, as a whole, is a net importer of all meats, owing to the large import demand of the United Kingdom, but the import balance has diminished appreciably in recent years. Of the imports in the United Kingdom in 1935, Empire countries furnished 24 per cent. of the beef and veal as against only 10 per cent. in 1929, and 81 per cent. of the mutton and lamb, compared with 59 per cent. With regard to bacon and hams, the Empire share of total imports rose from under 9 per cent. in 1929 to 21 per cent. in 1935.

The world trade in meat as a whole declined by about 12 per cent. between 1929 and 1935. The increase in world trade in beef during the immediate post-war period was followed by a downward trend up to 1932. Supplies were maintained at this reduced level in the two succeeding years, and an upward movement occurred in 1935. International trade in mutton and lamb experienced a marked increase in the post-war years to a peak in 1931. A declining tendency was in evidence in the three succeeding years, but was apparently checked in 1935. International trade in pig meat, which is dominated by the movement of bacon and hams to the United Kingdom, showed a marked rise to a peak in 1932, but was substantially reduced between 1932 and 1935 owing to the regulation of imports into the United Kingdom.

Fruit

THE Imperial Economic Committee has also published its annual summary of the world production of, and trade in, the chief kinds of fresh, canned and dried fruit.* It will be useful alike to those who are interested in the fruit supplies of the United Kingdom and to those interested in a growing Empire industry.

The review, which covers the period 1929-1935, shows that,

* *Fruit: A Summary of Figures of Production and Trade relating to Apples, Pears, Bananas, Citrus Fruit, Grapes, Wine, Raisins and Currants and Canned Fruit.* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. Price 2s. 6d., post free 2s. 8d.

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although the world export trade in apples, pears, oranges and lemons during 1934 and 1935 was, with each commodity, on the average on a somewhat smaller scale than in the 5 preceding years, the quantities of these fruits exported from Empire countries were substantially heavier. Further, exports of certain other fruits, including grapes, grapefruit and canned fruits from Empire countries, have continued to increase.

Changes in the world output of the different kinds of fruit are difficult to measure over short periods, but there is little doubt that since the War the general tendency has been one of expansion, more especially in those countries growing fruit largely for export; and trade has developed considerably, particularly in citrus fruits, bananas and the various kinds of canned fruits. In fact, exports of canned fruit increased steadily from 1930 to 1935, in which year they easily attained a new high level.

A distinctive feature of the United Kingdom trade has been the marked growth of the imports from Empire countries, which in 1935, a record year, were over seven times greater than in the years before the War. The Empire is a net importer of all the principal fruits, with the one exception, in normal years, of bananas. Expanding imports from the Dominions are, however, reducing the import balance considerably.

Interesting Birds: (5) The Song-Thrush

As well-known as the blackbird and as often seen in gardens and orchards, the song-thrush is with us all the year round. It is an accomplished singer, although inferior in this respect to the blackbird, and may be heard at seasons of the year when most other birds are silent. Its food is much the same as that of the blackbird. It is, however, less prone to take cultivated fruit, and has an especial liking for snails. Its good work in the destruction of these and other pests should be enough to commend it to the gardener. "Thrush-stones" are common objects of the countryside. An individual song-thrush will regularly use one particular stone on which to crack snails, and the ground around the stone will, in time, become littered with fragments of shell. The song-thrush's mud-lined nest, with its four or five beautiful blue, black-spotted eggs, is well-known to most country-folk. Like the blackbird, the song-thrush, when nesting, makes little



Copyright Photo Fr J Hock

Song thrush bringing food to young

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or no attempt at concealment, and sometimes rears two or even more broods of young in a season. It has always been one of our commonest birds, and is undoubtedly a beneficial species.

Quick Drying of Hay

The following note has been communicated by Mr. J. St. Bodfan-Griffith:—

SOME method for the quick drying of hay has been evolved in most parts of Scandinavia and North Germany, where the summers are either short or inclined to be wet. With the tripod method from North Germany many British farmers are acquainted. In Scandinavia, however, an even quicker method is practised, whereby the crop may be set up to dry at once. In Norway, where the rainfall is heavy, it is mostly grass that is dealt with, chiefly, no doubt, on account of the fact that grass grows relatively well and also owing to the difficulties of cultivating such mountainous country.

In Sweden, however, a special crop is usually grown for the purpose, made up of approximately:

17 lb. Swedish Red Clover	} per acre,
11 lb Timothy, and	
6 lb Alsike	

and included in the regular rotation of: fallow—winter wheat

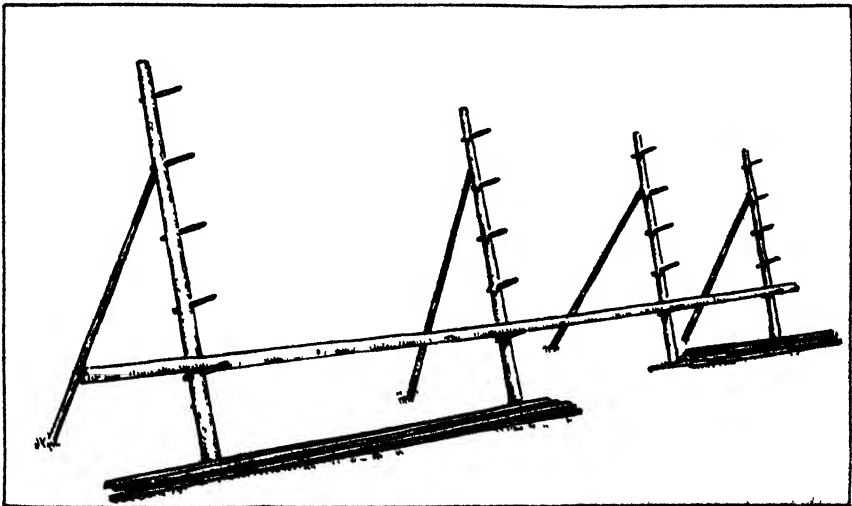


FIG 1 —Wooden rack in the making

—mixed corn—clover hay, for several seasons—and mixed corn again (Ultuna Rotation). The grass and clover seeds

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are sown down under mixed corn. Farmyard manure is applied in the fallow, phosphoric acid with the wheat and nitrogen and phosphoric acid with mixed corn again; sufficient potash being present in this district. The seeds crop is grown primarily for fodder, the first cut for hay, and the second (in August or September) for Silage (A.I.V.), and eventually grazed before ploughing in.

The hay crop is cut *when the first signs of colour are visible on the clover bud*, and is dried on "Hässjor." These "hässjor" or hay racks vary in construction and material, being modified to suit local conditions, but the principle on which they are designed is always the same. In the north, for example, where wood is plentiful and cheap, the racks are made entirely of wood (Figs. 1 and 2), whereas further south wire or cord is used instead of wood for horizontals, and we may take the latter as being more typically interesting.

Wooden stakes, 7-9 ft. long and pointed at both ends, are used for uprights; 9 of these are set up, 3-4 ft. apart, using a stout crowbar for making holes, and are best set on either side of a straight line for strength (Fig. 3), the end stakes being set at a slight slant away from the others, for the same reason. Pliable wire or tarred hemp line is then stretched across by securing it to the first stake and giving it a turn



FIG 2 —Wooden rack covered with hay

around each of the others in succession. On this the green crop is hung to dry.

Green clover may be hung up *at once*, but grass should lie for a few hours after cutting. The racks can be set up in the hay field as soon as a sufficient area has been cut to allow

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room for them. The hay is then brought up to the racks, as for cocking. A small horse-drawn sweep is most useful and practical for this purpose. The hay is then hung over the bottom line, using a hay fork. It is surprising how easy this is to do and how well the hay hangs in its green state. When the first line is covered, wire is stretched across, as before, leaving a space of from 2-4 in. above the covered line beneath, and more hay hung on that. It is then often advisable to make a support to prevent sagging in the middle, and this may be done quickly by securing a stake diagonally inwards from the end stakes of the rack. Hanging is then continued.

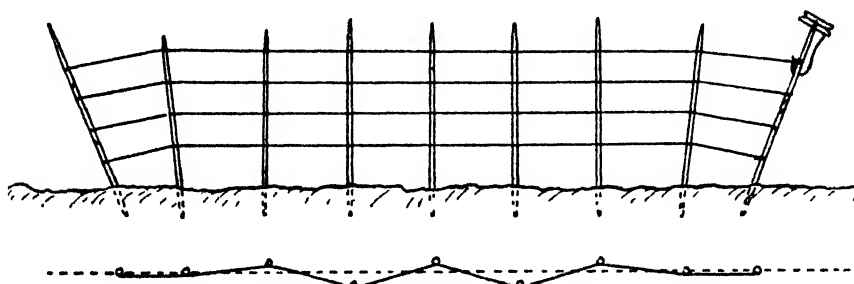


FIG. 3 — Rack with wire horizontals and end stakes sloping outwards. The plan shows position of stakes on either side of central line.

Once on the rack, the crop is safe for weeks and will be practically unaffected by rain or storm. This allows harvesting operations to go on steadily, uninterrupted, for example, by the necessity of carrying one field before cutting another in a wet season. The result is that all the crop may be cut in prime condition.

In good weather, the crop on the racks will dry in 2 or 3 days, but in wet seasons it may be necessary to leave it for a week to ten days before it is safe to carry it to stack. The more quickly it dries, the better the quality of the hay will be, and, of course, it should be carried as soon as possible after it is dry. Beyond this the possibilities of damage are infinitely less than with cocking.

A four-line rack of this kind, covered with clover hay, holds from 77-110 lb. of dry hay, per running yard, depending on the amount of moisture in the crop at the time of racking, and one man usually makes and covers 8 racks per day. At this rate 5 men would just about keep pace with a mowing machine.

The racks are made without difficulty, and it will be found

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no more trouble to hang up the crop than to make a cock—in fact, less skill is required than in good cockmaking, and it is certainly far less tedious and much quicker than all the turning so often necessary before cocking.

Jordbrukstekniska Foreningen, Uppsala, through whose courtesy the diagrams are reproduced, have worked out costs; those of two methods are given for comparison:—

Costs of drying 1 ton of hay, all costs of labour, material and transportation from the field included. Costs, calculated to the nearest $\frac{1}{4}d.$, represent averages from 4 farms in 1928

Method of drying	Labour valued at $6\frac{1}{2}d$ per hour		Horse labour valued at $5d$ per hour		Cost of materials	TOTAL
	s	d	s	d		
Cocks ..	2	5 $\frac{1}{2}$	1	5	—	3 10 $\frac{1}{2}$
Wire Racks .	2	11	1	6 $\frac{1}{2}$	5 $\frac{1}{2}$	4 10 $\frac{3}{4}$

It will be noticed that the difference in the cost of making hay on racks and in cocks is only one shilling per ton, or approximately 13 per cent. of its value, which is insignificant when the far higher feeding value of rack hay is taken into consideration. Even in wet seasons, drying hay on racks assures at least an average quality crop, whereas that dried in cocks under similar conditions, may often be so poor as to be of practically no value at all! In excessively hot or dry seasons, it has been found that hay dried on racks sustains less loss through withering and scorching of the leaves. In fact, rack hay made from a crop that is mainly clover is the sort most farmers long to produce; one has only to touch or smell it to be filled with envy, while for dairy cows, it is, in itself, almost a balanced ration. With 11-14 lb. of it, some silage or roots and a little home-grown crushed corn, in our dairy rations, we could wave goodbye to concentrates, as usually understood, for the rest of our lives!

Sampling Observations on Wheat 1936-37: Report for Second Quarter

The observations from appearance above ground to tillering date are summarized in the accompanying Table, which shows the date of tillering (defined as the moment when the number of shoots is double the number of plants), the rate of tillering and the plant number at tillering date.

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SAMPLING OBSERVATIONS ON WHEAT, 1936-37: SECOND QUARTER

Station	Variety	Tillering				Density (Plant number per 32 metres)	
		Date		Rate : Tillers per 100 plants per week		1936-37	Average 1932-36
		1936-37		Average 1932-36			
Boghall, Edinburgh	S.H.M.*	Apr. 16.71	Apr. 4.40	50.3	43.1	1,416	1,337
Cirencester, Gloucestershire	Yeoman ..	Apr. 15.41	Apr. 3.46	54.9	42.0	1,469	1,432
	S.H.M. ..	—	Feb. 16.13†	—	22.3†	—	886†
	Yeoman ..	Feb. 22.41	Feb. 11.37†	23.9	22.7†	1,656	935†
Rothamsted, Hertfordshire	Little Joss	Feb. 27.02	—	21.3	—	1,431	—
	S.H.M. ..	Feb. 21.84	Mar. 3.96	15.1	34.0	1,375	1,498
	Yeoman ..	Feb. 18.14	Feb. 23.32	18.4	25.9	1,688	1,578
Woburn, Bedfordshire	Victor ..	Mar. 6.09	Mar. 11.54	11.9	29.7	1,436	1,503
	S.H.M. ..	Feb. 15.98	Feb. 15.78	28.1	28.3	1,508	1,153
	Yeoman ..	Feb. 15.86	Feb. 15.23	33.1	33.0	1,698	1,137
Newport, Shropshire	S.H.M. ..	Mar. 30.77	Mar. 16.25	47.4	50.3	410	678
	Yeoman ..	Apr. 8.04	Mar. 14.41	45.1	38.6	198	645
	S.H.M. ..	Feb. 18.31	Mar. 19.90	20.3	44.1	1,538	1,265
Wye, Kent ..	Yeoman ..	Feb. 2.49	Mar. 20.92	16.7	44.3	1,530	1,278
Plumpton, Sussex ..	S.H.M. ..	Before Mar. 5	Mar. 16.07†	29.4	40.1†	364†	732†
	Yeoman ..	Mar. 11.43	Mar. 15.36†	26.8	41.0†	367	803†
Scale-Hayne, Devonshire	S.H.M. ..	Jan. 29.73	Jan. 11.10	19.2	29.8	1,698	1,478
	Yeoman ..	Jan. 27.94	Jan. 3.32	16.8	25.5	1,810	1,575
	No. 60 ..	Jan. 22.59	—	18.3	—	1,714	—
Sprowston, Norfolk ..	S.H.M. ..	Mar. 18.72	Mar. 9.44	35.4	33.1	2,013	1,171
	Yeoman ..	Mar. 21.94	Mar. 7.14	40.0	34.1	1,764	1,278
	S.H.M. ..	Apr. 23.00	—	57.9	—	848	—
Carlisle, Cumberland	Yeoman ..	Apr. 22.19	—	57.5	—	747	—
	Wilhelmuna	Apr. 24.28	—	40.6	—	887	—

* Squarehead's Master.

† 1933-36.

‡ On March 5.

NOTES FOR THE MONTH

The values for the present season may be compared with the averages for the four previous seasons, shown in adjacent columns.

The weather of the past quarter has been marked by unprecedented rainfall, deficiency of sunshine, and absence of frosts in January and February. The rate of progress of wheat in growth has, however, in most cases been normal up to tillering date, except that the three northerly stations, Newport, Boghall and Carlisle, were rather late. There was no exceptionally early tillering, the first date recorded being for the local variety at Seale-Hayne on January 22. Tillering took place during February at three stations. At Cirencester, Yeoman and Little Joss tillered towards the end of February, but Squarehead's Master lagged behind, and has not yet reached the 2 to 1 ratio, though the plant has now begun to increase its height. Of the remaining stations, Sprowston and Wye tillered during March and Newport, Boghall and Carlisle in April. It is interesting to note that at Boghall tillering is on the average three months later than at Seale-Hayne. By ear emergence, the average interval between the two stations has dropped to 16 days.

Squarehead's Master generally tillers slightly later than Yeoman, as the averages show, but this year there was no consistent difference between the two varieties, Squarehead's Master being much later at Cirencester and Wye, but considerably earlier at Newport and Plumpton.

The rate of tillering was slightly slower this season than usual, low values occurring at Rothamsted, Wye and Seale-Hayne, which are among the stations where tillering took place early. The highest rates occurred as usual at the late stations.

At most stations, plant elimination since the first count has been fairly small this year, presumably owing to the absence of severe frosts, and plant numbers are generally somewhat higher than usual. Exceptions are Plumpton and Newport, the two stations with the lowest average plant numbers. At Newport, indeed, Yeoman has almost failed, the plant numbers having dropped by about half since the first count on December 23. It will be interesting to see to what extent the plant recovers later. Last year, it will be remembered, Newport had a very sparse plant, yet produced the highest yield of all stations at harvest.

IMMATURE GRASS AND YOUNG SWARDS—I.

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The drying of grass, like all innovations, serves to emphasize a number of facts which have a significance reaching much farther than the ends immediately in view. The drying of grass is desirable, and when all the processes are perfected will be of immense importance, for the sole reason that it affords a means of storing immature grass.

We are perhaps inclined to forget that the product must always come before the means of putting it to some new purpose. Nor must we forget that immature grass is always valuable, whether dried or not; indeed, it is probably most valuable when it is on the field, still alive and growing. Facts are being accumulated as to technique and costs of drying grass to be used primarily as a concentrated winter and off-season feed. It is therefore certainly logical that inquiries should be set on foot to ascertain whether it might not be more satisfactory, and cheaper, to produce at least some proportion of the immature grass required for the winter and for other difficult times of the year.

The grazing year divides itself naturally as follows:—

- (1) January to end of March (in late and hilly districts, to end of April).
- (2) April to end of June.
- (3) July and August.
- (4) September to early-middle October.
- (5) Early-middle October to January.

In most districts, and in most years, the only comparatively safe grazing periods are April to June and September to early-middle October. Frequently during both of these periods properly-managed swards will produce more immature grass than the farmer can contrive to convert there and then, and on the spot. In some years the period July-August is highly critical, while in most years it is a period that presents considerable anxieties to the grazier. In practically all districts the period January-March is much more critical than the period mid-October to December. It would probably be no exaggeration to say that at least 70 per cent. of the grassland problem centres on the three difficult periods,

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July-August, mid-October to December, and January-March, and in this rising scale of importance. In cold fact it is quite impossible to work out a rational technique of grassland management before and until the economist will be obliging enough to inform the agronomist as to the precise value of the dry matter in a ton of immature grass (a) dried and nicely stored away in the barn, and (b) out on the field and still alive at each of the five periods of the year above mentioned.

It is not the intention of this paper to attempt to assist the economist to do his own job, and the question of costs of production will not be once mentioned; the intention is to discuss some of the more important aspects of the problems involved, and to show that immature grass in considerable quantities can be produced on the field at each of the most critical periods. It will also be shown that animals thrive on such grass.

The Characteristics of Immature Grass. Although the chief facts about immature grass are now generally known, a brief statement will not be out of place, while certain characteristics of such grass deserve more consideration than they have anywhere received.

Immature grass is in a state of active growth; it consists of a high proportion of leaf, and leaf is more nutritious than stem; it is highly concentrated in proportion to its immaturity.* the ultimate chemical properties of immature grass show considerable seasonal variation, and it would appear from the results of the researches conducted at the Hannah Dairy Research Institute† that the biological values of the proteins themselves show marked seasonal differences. Thus it has been shown that the biological value of autumn immature grass is not as high as that of spring immature grass for milk production, the proteins of the latter being richer in lysine. This is not to say that the proteins of autumn, or indeed of winter, grass are not valuable, or that

* The range of chemical differences as between hay and pasture grass, leaf and stem, and herbage of different periods of growth, burned herbage and green herbage, and other details are concisely shown by Fagan. See Fagan, T. W., The nutritive value of grasses, *Jour. Univ. Coll. Wales, Agricultural Department*, Vol. XVI, 1927; and Fagan, T. W., The influence of management on the nutritive value of herbage plants, *Agric. Progress*, Vol. VIII, 1931.

† See Morris, S., Wright, N. C., and Fowler, A. B., The nutritive value of proteins for milk production, *Jour. Dairy Res.*, Vol. VII, No. 2, May, 1936.

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they may not be of particular value to particular classes of stock; nor is it to say that by the adoption of appropriate methods it may not be possible to grow grass capable of producing "spring" proteins in the autumn. These are matters to which reference will again be made at a later stage.

A very important property of immature grass is its succulency. We know all too little as to what constitutes "succulency," but we do know that succulent herbage is palatable and that it contains a higher percentage of water of constitution than does less palatable and more mature herbage. In this connection it is important to emphasize that the water content of herbage is high in proportion as it is growing rapidly, and there is strong presumptive evidence in support of the view that herbage is nutritious (or, if not "nutritious" in the nutrient or ingredient sense, at least serviceable to the animal) in proportion to the accentuation of these properties. An animal thrives well according as it can make for itself long rests between its periods of grazing and of chewing the cud. The point about a succulent herbage is that an animal will eat more per unit of time than it will eat of a less succulent and more mature herbage, and moreover, the animal will eat sufficiently more to have taken in more dry matter (and therefore, proportionately, considerably more nutrients, for the dry matter of succulent herbage is richer than that of less succulent herbage) from the succulent (and watery) herbage than from mature (less watery) herbage.*

The time factor is one of great importance as affecting the serviceability of food-stuffs, and particularly of herbage plants growing *in situ*. Properly, digestibility (which in effect implies the usefulness of a food) should take heed of this factor. In the chemical analysis, of *e.g.*, "digestible protein," no value can of necessity be given to the time factor as here understood. A food-stuff with a higher digestible protein might in fact be less serviceable to the animal than

* The evidence for the views here expressed was derived from experiments conducted at the Welsh Plant Breeding Station during the period 1925-1926.

See Stapledon, R. G., and Jones, Martin G., The sheep as a grazing animal and as an instrument for estimating the productivity of pastures, *Welsh Plant Breeding Station Bulletin*, Series H, No. 5, 1927; and Jones, Martin G., Comparison of pastures by means of sheep, *Welsh Jour. Agric.*, Vol. IV, 1928.

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one with a somewhat lower figure, if the former food (because less succulent) were in a form that the animal took longer to eat or to collect. It is interesting in this connexion to speculate whether 1 lb. of dried grass with the succulence driven out of it is as serviceable to the animal as 1 lb. of dry matter of the same grass undried. Whether moistening a dry food is to give that food succulence (its water of constitution) again must be open to considerable doubt.

Succulence is a matter demanding most detailed research. Thus, if it were proved that dried grass was less serviceable than immature grass on the field we should have a further argument in favour of producing off-season and winter grass *in situ*.

Two further facts deserve mention. Clover is not only richer in protein than grass but richer also in water of constitution. Clover is altogether more effective in fattening sheep than is grass.* Water of constitution is a variable of variables; it is influenced not only by rapidity of growth, but also by weather conditions as such. The herbage taken in wet weather, however, always also carries extraneous moisture, so that the animal has to deal with all this extra water and perhaps an excess of succulence as well. Be this as it may, in a dry year there will not be as much liveweight increase per acre as in a wet year, but the liveweight increment per unit of dry matter will be greater.* It may be that the serviceability of a herbage plant bears some relation to an optimum figure of succulence; the grasses vary very considerably amongst themselves in their percentage moisture, while grasses as a class tend to be richer in dry matter than either the legumes or the miscellaneous herbs. To adopt percentage dry matter as a criterion for estimating the value of a fodder plant, particularly a grass, clover or miscellaneous herb, subjected to selective grazing, is assuredly to pin one's faith on a standard of very questionable validity.

Factors Favouring Rapid Growth and Succulence.

Rapidity of growth in plants and animals alike is to a very real extent a matter of youthfulness. This is true of swards; young swards grow faster than old ones. Critical sward trials have been conducted at Aberystwyth for the past 17

* See Jones, L.I. Iorwerth, The feeding value of pastures sown with different strains of grasses and clovers, *Emp. Jour. Exp. Agric.*, Vol. IV, No. 15, July, 1936.

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years, and as a result of such trials it has been possible to form a sound judgment upon certain aspects of the grass land problem which the trials as such were not designed to test, and upon which it is almost impossible to obtain reliable statistical evidence. Thus it is impracticable to plan a satisfactory experiment designed to test herbage yield from year to year irrespective of weather conditions. If the same mixture is repeatedly sown year after year, the weather conditions at the time of sowing and establishment will never have been twice the same. Examination of all the data collected during this 17-year period, and close association with the experiments, however, leave no doubt that sown swards tend to fall off in both rapidity of growth (and therefore in succulence) as the years advance, and in total yield per acre per annum. This falling off in yield and rapidity of growth would seem to be greater than could reasonably be accounted for by the slower-growing invaders like *Agrostis* that may have replaced the quicker-growing sown species. Yield and rapidity of growth tend to fall away in the quicker-growing sown species themselves in proportion as the sward increases in age.

Such evidence as has been obtained in terms of liveweight increase tends to confirm this view, and the only conclusion that can be drawn is that temporary grass (leys of from one to about six years' duration) are heavier yielders of succulent herbage than all but possibly the very best permanent pastures. Much more important, however, is the fact that the temporary leys yield more succulent herbage during the critical periods mid-October to December and January to March than do permanent swards. As bearing on this question it is highly significant that hill sheep farmers looking for wintering grounds for their younger ewes and lambs always prefer farms where temporary leys contribute in fair measure to the land under grass rather than holdings wholly in permanent pasture.

An indication of the monetary value of winter herbage is afforded by evidence collected by Dawe and Blundell* as the result of an examination of records obtained on 133 dairy herds in the Bristol Advisory Province. They put forward at a tentative estimate that 1 lb. of starch equivalent is worth 0.43d. when taken in the form of winter grazing from

* Dawe, C. V., and Blundell, J. E., Winter Feeding for Milk Production, *Univ. of Bristol (Dept. of Agric. and Hort.)*, Bul. No. 16.

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permanent pastures. On some farms the estimated *cost* was as low as 0.28*d.* per lb. These figures must be compared with a cost of 1.09*d.* per lb. of starch equivalent in the form of concentrates. Although, taking no account of the extra value of winter grass in terms of protein as such, and of carotene, these data nevertheless suggest that the expenditure of not inconsiderable money would be justified in the production of winter grass and by means more intensive than merely the conversion of low-grade permanent grass into high-grade and long-duration temporary grass. The farmer should aim at altogether higher yields than could be obtained from even good, ordinary leys ordinarily managed. It is more than probable that by the adoption of appropriate methods he could obtain yields so much higher than those to be had from permanent pastures or from ordinary leys, that in addition to enormously increasing his supplies of winter grass he would reduce the price per lb. of starch equivalent.

The Production of Winter Grass. Four methods are open to the farmer for the special production of winter grass. These are:—

- (1) To sow fields down to Italian rye-grass primarily for winter use.
- (2) To grow special winter-growing grasses in cultivated drills.
- (3) To use special mixtures for long-duration swards, to obtain the maximum of winter grass.
- (4) To accumulate foggage from leys or from drills sown with such an object predominantly in view.

(1) *Italian Rye-grass for Winter Feed.* Experiments have been conducted for many years at Aberystwyth in the production of Italian rye-grass for winter feed. The rye-grass has been sown (a) in an ordinary oat crop, when it grows away fast in the stubble; (b) with an oat crop that is cut for hay, this procedure ensuring a quicker and more robust development of Italian rye-grass; (c) in June with rape; and (d) as a pure crop in May, June or July. When sown with oats (either for grain or for hay) the rye-grass sward is always dressed with nitro-chalk immediately after harvest; when sown pure or with rape the sward receives nitro-chalk in late August or September.

The Italian rye-grass may be either grazed intermittently from September to April, or it may be in the main reserved for March and early April (lambing time). If it is required more-particularly for lambing time it should be grazed fairly

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close in September, and again lightly once or twice, and rested completely from about the middle of October. This latter procedure ensures a good yield of highly nutritious fodder in March; higher yields, but of a less nutritious fodder, will be obtained in March if the field is only grazed off in September.

The point to be insisted upon is that Italian rye-grass (properly manured) is capable of making appreciable growth all through the winter. At Aberystwyth, samples taken from a grazing experiment* showed a yield of never less than 200 lb. of dry matter per month per acre, and a total yield from monthly cuts (corresponding to monthly grazings September to March) of 3,521 lb. of dry matter per acre. The yield in March from plots rested since September was 944 lb. of dry matter per acre, while that from plots again grazed in early December was 719 lb. per acre. The yield of crude protein per acre was 245 lb. from the former plots, and 282 lb. from the latter, while the crude protein taken under a system of monthly grazing (seven grazings September to March) was 456 lb. The contribution of crude protein to the dry matter (in March) varied from 15.75 per cent. on the plots grazed monthly to 12.71 on those rested since September. All through the winter Italian rye-grass was producing a fodder with a crude protein percentage of never less than 12 per cent., and this was in exceedingly palatable fodder with a high leaf to stem ratio.

These data are of particular significance; they were obtained from small plots as long ago as 1927, and have been the forerunner of a prolonged and successful use of Italian rye-grass. Thus Griffith and Jones† have reported upon an experiment conducted in 1929-30 in which Italian rye-grass was rested from October 1 to December 27, having received a dressing of 1 cwt. nitro-chalk per acre. By December 27 there was a thick sward of Italian rye-grass, 6 to 8 in. high. Sheep were then grazed on the Italian rye-grass for two hours a day, the remainder of the 24 hours being spent on an adjoining block of rough pasture. The rye-grass—three acres—*cum* rough grazing (which had very little feed to

* Stapledon, R. G., Fagan, T. W., Evans, R. E., and Milton, W. E. J., Italian rye-grass for winter and early spring keep, *Welsh Plant Breeding Station Bulletin*, Series H., No. 5, 1927.

† Griffith, M., and Jones, M., Italian rye-grass for winter keep, *Welsh Jour. Agric.*, Vol. XI, 1935.

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contribute) maintained 35 sheep from December 27 to April 5, and this without by any means completely utilizing all the rye-grass. Results of a similar nature have been obtained year after year in recent years on the farm lands of the Cahn Hill Improvement Scheme, though there we have usually kept the grass in the main for lambing. An area of Italian rye-grass has, however, proved invaluable all through the winter as a temporary "hospital" for weakly ewes. The inherent feeding value of Italian rye-grass has been well illustrated by a further experiment conducted at Aberystwyth.* In a period August 23 to September 13 lambs fattening respectively on rape, hardy green turnips and Italian rye-grass actually put on more weight on the Italian rye-grass (80 lb. liveweight per lamb) than on hardy green turnips (6 lb.), or on rape (3.5 lb.); by September 23 the lambs on the rape had, however, further increased in weight and gave the maximum yield (95 lb.); those on the Italian rye-grass had fallen from the weights attained on September 12 by 2.7 lb. per head. This result is of significance as showing that grass as it matures (the ration offering was always adequate) falls off in fattening properties more quickly than does rape, and affords an interesting side-light on the importance of rotational grazing. It also emphasizes the care that needs to be exercised in the matter of the date at which fields should be closed in order to provide the maximum of nutritious grazing—*bulk* is not everything; but to this aspect of the question we shall presently revert.

(2) *The Growing of Special Winter Grass in Cultivated Drills.* For the purposes of seed production the larger grasses are grown in drills, the ground being kept well cultivated between the drills. Such drills make considerable growth during the winter, and as Fagan has shown, produce a fodder somewhat richer in protein than that developed from the same species in sward.

A strain of timothy (S.48)† bred at Aberystwyth has proved itself particularly satisfactory as a winter grass when grown in this way. At the farm of the Cahn Hill Improvement Scheme this strain has been grown in drills for wintering lambs. A hay or a silage crop is taken from the timothy which is subsequently rested until December, save perhaps

* Griffith, M., and Hutton, P. M. G., The lamb-fattening capacity of certain crops for hill conditions, *Welsh Jour. Agric.*, Vol. XII, 1936.

† "S" denotes Welsh Plant Breeding Station pedigree strain.

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for one or two light grazings, then from December to April lambs running on an adjoining old pasture are given two hours a day on the timothy. Seven acres of timothy drills *cum* ten acres of poor pasture in 1934 maintained 98 lambs as a slightly gaining weight from December 6 to March 15.*

These lambs were wintered at about 850 ft. above sea-level; they were maintained by this procedure in a thriftier condition than similar lambs wintered away in the lowlands. The "timothy" lambs had put on about an average of $\frac{1}{2}$ lb. per head; the lowland lambs had dropped about 1 lb. per head. These timothy drills have also, like the Italian rye-grass, proved invaluable as a "hospital" for weakly ewes, such ewes recovering rapidly when given access to such grass for a week or two. So much for winter protein grown *in situ*.

The practical economics of winter grass grown in this way awaits upon the correct evaluation of winter grass, and upon devising the cheapest possible means of cultivating drills subjected to the constant and heavy treading of animals. The conservation of spring and summer grass by drying or by silage costs money, while as every flockmaster knows to his consternation, sheep have an uncanny preference for young green grass *in situ*, and show a marked antipathy to hand feed if and when there is even the minimum of green grass to be had.

(3) *The Use of Special Seeds Mixtures.* The precise species and strains that are employed for the production of winter grass are of an importance second only to management. From what has already been said it follows that Italian rye-grass should form an essential ingredient in all mixtures with the object of providing winter grass during the first winter after sowing. If the winter grazing will be hard as much as 10 lb. per acre of Italian rye-grass can be added to any ordinary seeds mixture: the presence of Italian rye-grass serves the additional purpose of protecting the smaller and less rapidly growing species from being grazed too hard. In respect of all species of grass the indigenous and leafy strains are more heavily winter yielding and more winter green than are the ordinary strains of commerce; indeed, this is the most important characteristic of the

* Griffith, Moses, and Hutton, P. M. G., The wintering of sheep on temporary grasses, Part I, *Welsh Jour. Agric.*, Vol. XI, 1935; Part II, *ibid.*, Vol. XII, 1936.

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indigenous strains. Evidence from one of our comprehensive experiments* has shown that in respect of four species (perennial rye-grass, cocksfoot, meadow foxtail and red fescue) the amount of grass produced in December and January was $2\frac{1}{2}$ times as much from the indigenous strains as from the commercial. The amount of grass produced in March from the same four species was in the ratio commercial strains to indigenous strains as 100 : 150. The highest yielding winter grasses have been the indigenous strains of the four species immediately under consideration. The exceedingly high-yielding ability of indigenous red fescue (S.59) is particularly noteworthy; this grass is also exceptionally winter green, and although, like all the fine-leaved fescues, relatively unpalatable, it is readily grazed by stock during the winter. A simple mixture consisting of indigenous meadow foxtail (S.56), indigenous red fescue (S.59) and wild white clover has proved to be one of the most winter green and productive of the mixtures employed at Aberystwyth for winter grazing†. Plots and fields sown with such a mixture have always been outstanding in appearance during February and March, and it is then that they are probably of their greatest relative usefulness; indeed, in February the yield of such plots has generally been in excess of those sown predominantly with indigenous perennial rye-grass (S.23), which latter strain must perhaps be regarded as the most generally satisfactory of all winter grasses for use in long-duration leys.

During the whole period of these winter grazing experiments (1927 to the present time) it has been rendered patent that winter grass is only developed in good quantity from leys subsequent to the first winter after seeding (when Italian rye-grass is the chief contributor) if the swards are well endowed with wild white clover. Wild white clover is always an ingredient in all our mixtures, and the basic slag at a rate

* Stapledon, R. G., and Milton, W. E. J., Yield, palatability and other studies on strains of various grass species, *Welsh Plant Breeding Station, Bulletin*, Series H, No. 13, 1932.

† A simple mixture consisting of indigenous meadow foxtail (S. 56), indigenous red fescue (S. 59) and wild white clover is necessarily expensive, but whether such a mixture is prohibitive awaits upon the proper evaluation of winter grass. At the present time supplies of the red fescue (S. 59) are generally available in fair quantities, but owing to lack of demand (at a necessarily high price) seed production has not been proceeded with on a large scale with the meadow foxtail (S. 56).

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never less than 6 cwt. per acre is always applied at the time of sowing.

(4) *The Accumulation of Foggage from Special Leys.* Foggage has always been employed for winter keep as a standard practice on many farms, but what is foggage, and how should it be produced? The art of producing winter grass raises a great many involved questions: what is wanted is the maximum possible amount of green and succulent leafage of a good protein content. Two considerations follow from this. In the first place, if too large a bulk of stuff is allowed to grow up and stand in to the winter the whole will become excessively burned and of relatively poor nutritive value, while the excess of burned and over-topping material will effectively put a stop to any further and contemporaneous growth of young leafage. In the second place, the winter-green species will stand-on as nutritious foggage better than the more readily burning species. Long foggage, consisting of bent and sheep's fescue, will be of relatively little value, and of altogether less value than a shorter foggage consisting largely of the still green leafage of grasses like the rye-grasses, timothy and even Yorkshire fog if this latter grass has not been allowed to grow too long. The figures given in Table I, which are based on data kindly provided by Professor Fagan, illustrate this point. The analyses are for winter grass (February 6, 1936) grown at the Cahn Hill Improvement Scheme by the various methods previously discussed, in comparison with over-grown foggage from a but lightly grazed and unimproved bent-fescue pasture.

TABLE I.—TO SHOW THE MAIN FEATURES IN THE CHEMICAL COMPOSITION OF WINTER GRASS VARIOUSLY PRODUCED. *Percentage of dry matter.*

	Timothy rows	Italian rye-grass	Improved sown sward*	Unimproved bent-fescue pasture
Crude protein (including true protein) ..	13.44	14.68	18.90	7.08
Phosphoric acid ..	1.08	1.24	0.85	0.16
Lime	0.56	0.72	0.55	0.20

* Consisting of Yorkshire fog, perennial rye-grass, crested dogstall, a little cocksfoot and wild white clover.

It should be pointed out that the timothy rows had been allowed to grow-on from hay harvest, so that a certain

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amount of burning had taken place, and the same was true of the Italian rye-grass, which had not been grazed since the covering crop of corn had been harvested for hay, yet the protein contributions are remarkably high, notably lower, however, than those of the improved sown sward. The latter sward had been grazed off in the early autumn, rested for a period and then grazed hard all through the winter; thus treated, the protein content (in February) is seen to be excellent, despite the fact that Yorkshire fog was one of the chief contributing species.

Further and valuable evidence is given by the experiment on Italian rye-grass which we first discussed. When the rye-grass was allowed to grown-on without once being grazed from the time the corn was harvested (August) until March, 401 lb. of green Italian rye-grass leaf per acre were available in March; when, however, the rye-grass was grazed off in September (and therefore a less abundant over-topping leafage was carried into the winter), the amount of green leaf actually available in March was 529 lb. per acre. It follows that the foggage carrying over from September was in every way superior to that carrying over from August; the former "foggage" available in March consisted of more growth actually made during the winter (Italian rye-grass being capable of quite considerable winter growth) and therefore naturally of more green leafage than the latter.

In putting fields up for foggage—or it is better to say for winter grass, for it is emphatically not dead and burned material that is wanted—much must depend upon the date at which the gate is closed upon the field. The whole question is now under detailed experiment at the Welsh Plant Breeding Station, and a report dealing with the matter from the point of view of chemical composition and of yield will shortly be published. Professor Fagan's data, however, show that the protein content (crude protein) of the materials analysed has been remarkably high, having in no instance been lower than 14.83 per cent., and having reached a figure as high as 22.10 per cent. The experimental areas were closed to stock at different dates from August 1 to November 1. The most interesting fact that is emerging from these experiments is that, provided the leafy and indigenous strains are employed in the seeds mixtures (the data immediately under discussion were from ley plots in their second harvest year), winter grass of remarkably high protein

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content can be obtained from areas put up as early as the beginning of August. The winter grass from plots thus treated has corresponded to yields of dry matter available in February (sampled February 26) of from 142 lb. to 1,117 lb. per acre, the highest yields having been obtained from plots put-up early in September.

The chemical analyses that have been presented denote a very valuable winter fodder; results of a similar nature obtained from plots on a permanent pasture, or on a field which had in any event been down to grass for a number of years at Cockle Park, have been reported upon by Brynmor Thomas and Boyns.* Here the plots were put up on August 4, and let grow till October 27, when winter grazing commenced. The grass throughout the winter period (under grazing) gave a crude protein percentage of never less than 12.91 per cent., with a season mean of 13.82 per cent.; it was found, however, that "the digestion-coefficients fall with great consistency to a minimum in January and rise thereafter."

An interesting feature of all these foggages, except that derived from over-grown bent and fescue, is that in protein content they have proved to be superior, and in many instances vastly superior, to hay; thus, in the Cockle Park results a more or less comparable hay gave a crude protein content of only 9.53 per cent.

* Brynmor Thomas and Boyns, P. M., The composition of grass laid up for winter keep, *Empire Jour. Exp. Agric.*, Vol. IV, No. 16, October, 1936.

[To be concluded.]

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THE maintenance of a good supply of organic matter in soil is of great importance in horticultural work. With intensive cultivation and tender crops, this particular aspect of soil management becomes even more vital. For those who enjoy an abundant and cheap supply of stable manure there is no difficulty; weeds and crop-remains can go to the bonfire, to yield plant ash, burnt soil, and a satisfactory feeling that diseased material has been faithfully destroyed. In most gardens and allotments, however, there is a growing scarcity of animal manures, and the situation has to be met by making full use of the waste organic material produced on the land itself. The bonfire must accordingly be reduced to its smallest limits and confined to woody prunings, old pea sticks, diseased material, and the roots and underground stems of docks, bindweed, creeping thistle and the like. All other vegetation, including vegetable trimmings and faded flowers from the house, should find their way back to the soil.

Compost making, by rule of thumb method, is as old as agriculture itself. In the peasant farming of the Continent the compost heap is used as a means of rotting down waste plant material that is too coarse and resistant to be employed as litter for livestock. The waste is put up in alternate shallow layers with earth, road scrapings, ditch cleanings and so forth. A sprinkling of chalk or lime is occasionally given as the heap is made, and the mass is watered from time to time, liquid manure being used when available. The process is slow, and one or two turnings are required in the course of the 18 months that the heaps are left to mature. The final result is a very rich calcareous soil, high in organic matter or humus and rich in nitrate. The application of this procedure to horticulture is limited, but the method may be used to deal with some of the materials mentioned above as likely constituents for the bonfire. Treated in this way and given time, twitch, cabbage stalks, twigs, rootstocks of perennial weeds, dead leaves and so forth can produce an earthy humus

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excellent for topdressing borders and lawns. Moreover, the labour of turning and carting material of this kind is less exacting under garden conditions than it is on a field scale.

The treatment of vegetable refuse without the use of soil is much more important than the process just described, and has received detailed scientific study. As a result a certain precision has been conferred on the production of organic manures from waste materials that was quite absent from the older methods. A statement of the leading facts may be useful.

To be of service to the growing crop a preliminary rotting of organic matter is quite essential; indeed, raw vegetable material turned straight into the ground is more likely to depress than to benefit the crop that is planted upon it. The rotting is caused through the activity of bacteria and fungi normally present in the original material so that no inoculation is required. The organisms decompose the sugars, starches and cellulose for their own nutrition provided they have sufficient readily available nitrogen and minerals to "balance their ration". The cultivator is concerned with the end point: that is to say, with the humified mass consisting largely of the cell substance of the countless organisms that have multiplied in the heap, together with plant constituents such as lignin, the chief components of woody tissue, which are too resistant for them to attack. The success of the rotting process therefore depends on the proportions of easily decomposable carbohydrates relative to nitrogenous and mineral substances in the heap. If the material is high in carbohydrates and low in nitrogen, decomposition will be slow, but what little nitrogen is present will be firmly held. If the mass is poor in carbohydrates and rich in nitrogen, decomposition will be brisk and nitrogen will be lost. The aim is to secure a correct balance between these two classes of substances, striking a middle course between the above extremes. Before indicating how this may be done in practice, the other requirements for successful decomposition may be mentioned—namely, adequate aeration of the heap, presence of sufficient moisture, and enough basic material (usually chalk or ground limestone) to maintain a neutral or weakly alkaline reaction.

The control of the balance between carbohydrate and nitrogen may be partly, but seldom entirely, controlled by the skilful blending of different kinds of plant material. This

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depends on the fact that young fresh green growth, such as lawn clippings, weeds, vegetable tops and the like, are considerably richer in nitrogen and minerals than mature tissues such as ripened straws, woody stems of herbaceous plants, and dead leaves. The first class also is naturally much less lignified than the second. The behaviour of these two grades of materials when put up into a heap is quite different. Grass cuttings, for example, will heat in a few hours, and in a week or two reduce themselves to a brown, slimy mass that, judged as a manure, lacks bulk, texture and fibre. On the other hand, straw will remain for months or even years almost unchanged. Neither of these results is desirable. The proper course is to use the excess nitrogen and minerals of the young green stuff to help the poorer and more fibrous material to decay. To do this a certain amount of grading of garden rubbish is required. Three grades may be distinguished; the first comprises soft green material such as grass cuttings, weeds, flower-bed and vegetable trimmings; the second, more fibrous material such as mature growths from herbaceous plants and kitchen garden; the third, woody material such as light prunings from shrubs and hedges, dead leaves, and dried litter. Straw or bracken, if available, will also fall in the last class. Hard and fast rules for the blending of these cannot be laid down, but as a working guide it may be said that the more mature and woody material that is present the higher the proportion of soft stuff should be, 1 part of grade 2 might have an equal quantity of grade 1, while 1 part of grade 3 might have 2 parts of grade 1.

The procedure is then as follows. A site is chosen, preferably in some out of the way spot shaded from sun and wind, and conveniently situated for water. Since the fermentation requires air, deep pits or even tall heaps are to be avoided, but a low concrete retaining wall about 2 ft. high makes a neat job. The actual size of the site will depend on the amount of waste to be treated, but it should be big enough to hold two heaps that will not exceed $2\frac{1}{2}$ ft. in height. If two heaps are provided for, it will be possible to start on the second while leaving the first to mature.

The raw material, blended as far as possible on the lines suggested above, is built up in successive shallow layers about 6 in. deep, each layer receiving a sprinkling of chalk or powdered limestone and sufficient watering to wet the mass

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thoroughly. In a few days, the heap will begin to get warm, and nothing need be done for about 6 weeks, when the first turning may be given; a second turning after another 6 weeks may be necessary to complete the job. At each turning additional water may be given, and in drying weather water may also be required at other times

The Acceleration and Control of the Rotting Process.

Although the procedure outlined above will usually yield a satisfactory end product, quicker and better results can be obtained by adding to the heap some reagent to supply available nitrogen and lime. Such a reagent is calcium cyanamide, a well-known nitrogenous fertilizer with basic properties, sold in the form of a black, rather dusty powder. When using this material, chalk is not necessary, the dusting being carried out layer by layer, using calcium cyanamide at the rate of about 1 lb. per large barrow load of average mixed garden refuse. From what has already been said the quantity of cyanamide will naturally be measured according to the state of the refuse, moist sappy green material requiring less and hard woody material more.

The pioneering work on the rotting of straw and other vegetable wastes by artificial means was carried out at Rothamsted, and the chief findings have already been mentioned. A development of this work is the well-known Adco reagent, extensively used in the making of artificial farmyard manure under controlled conditions. Many vegetable wastes have been successfully employed as starting points, but for the purposes of this article, straw, bracken, and mixed garden refuse will be those of most direct interest.

Those employing the Adco process will find the procedure for various classes of refuse carefully laid down. The reagents supply nitrogen, phosphate and a base, and two grades are available, one for the coarser and more resistant materials, such as herbaceous stalks, dead leaves, potato haulm, pea and bean haulm, and cabbage stalks; the other, less highly nitrogenous, for the softer fresh materials. A pit 2 ft. deep with a low surrounding bank of earth is recommended. The waste is spread in layers 6 in. deep, each layer being thoroughly wetted with water and sprinkled with reagent at about 2 lb. per large barrow load. At least one turning is required after about a month. The period of

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rotting is 2-6 months, depending on the degree of decomposition required.

A few general points applicable to all compost heaps may be emphasized.

Rotting of the raw material is essential, and a brisk initial heating is desirable. This denotes that conditions for decomposition are correct and the high temperature probably kills many weed seeds and runners. To obtain this initial heating good-sized heaps are necessary, and shelter from wind is desirable. Heaps should be kept moist, and here again shelter from wind is a great help. Soil need not be shaken from the weeds, for a certain amount helps to compact the heap and restricts water loss. Small green stuff, such as lawn clippings, has the same effect, filling the open spaces in a loose heap of woody material. Since watering is laborious, heaps should be so shaped as to let in rather than shed the natural rainfall. Excessive watering, although not a common mistake, has the bad effect of washing out soluble potash, and if the heap becomes waterlogged highly unpleasant fermentation products arise.

Time will ultimately correct many of the faults in compost making. If decomposition has been slow, or it is feared that perennial rootstocks may still be alive, or woody material is still in evidence, the remedy is to leave the heap a little longer.

A SURVEY OF THE GRASS LAND OF HERTFORDSHIRE

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HERTFORDSHIRE, in the past, has been a predominantly arable county—"the first and best corn-growing county in the Kingdom." From 1885, however, the arable area has tended to decrease and during the decade 1924-1934 this change was greatly accelerated. The area under permanent grass increased markedly until at the present time the agricultural land of the county is about half arable and half grass land (Table I). "Dairying is the most important individual enterprise in the economy of Hertfordshire Agriculture,"¹ so that the keeping of dairy cows and young cattle, an increase in the numbers of grassland sheep and to a lesser extent the running of pigs and poultry on grass, reflect the ways in which this additional grass is being utilized.

TABLE I
STATISTICS OF AGRICULTURAL LAND IN HERTFORDSHIRE

	1885	1907	1924	1934
Total acreage under—				
Crops and Grass	341,381	328,243	315,391	290,038
Per cent. Arable	68·7	62·0	61·4	51·3
„ Permanent Grass	31·3	38·0	38·6	48·7

In addition, "hay is the second most important cash crop grown in Hertfordshire . . . the area cut for hay covers 27·5 per cent. of the total farmed land, and of this, meadows account for almost exactly half, mixed seeds for one third, and clovers, sainfoin and lucerne the remainder."¹

In view of this development, it is not surprising that considerable attention has been paid to educational work on grass land problems. One way in which this work has been carried out in the county in recent years, has been to run grass land competitions in those areas in which grass land is

* References are given on p. 343.

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most concentrated. Briefly, these competitions were conducted as follows:—

Farmers in a given area were invited to enter *all* their grass land for the competition and the number of competitors in each competition area varied from 14 to 23. Each field on each farm was inspected separately. Generally, two inspections were carried out, one in May and one in September. Opportunity was taken to advise the farmer (where advice was deemed necessary) on managerial and other problems on the spot. Prizes were awarded as encouragement to entrants. When the field work was completed each farmer was sent a confidential report on the condition of his grassland, and directions for improvement, better manuring, and management given for each field. Also, a general report on the condition of the grass land of the area was issued to each competitor. In these ways, farmers have had the opportunity of becoming familiar with modern methods of improving and managing their grass land.

In the course of these inspections, certain field records have been kept, and an analysis of these affords a fairly reliable picture of the general condition of the grass land in each area. Some of these records may be of wider interest, especially in view of the emphasis that is being laid on nitrogenous manuring of grass land, and more recently on the possibility of grass drying in this country. They also serve as a check on estimates (see e.g., ref. 2) of the condition and requirements of the grass land of the country as a whole.

The data presented below concerns the condition of the grass land in four different areas in the county, totalling 8,215 acres. Four main soil types are covered, namely, London Clay, Boulder Clay, Glacial Gravels, and Clay with Flints, and there was also a small area of chalky soil. The data deals with the need of drainage, the need of lime, the degree of mattiness, the use of fertilizers and manures, weed flora, and some miscellaneous developments in grassland management.

All the records were collected in the seasons 1932-1935. In Table II, the districts and soil types, the acreages involved and the relative amounts of new and old pastures are tabulated. "New pasture" refers to land laid down during and since 1924, "old pasture" to land laid down before that time.

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TABLE II

District	Chief Soil Type	Total Acreage	Acreage Old Pasture	Acreage New Pasture
Barnet	London Clay ..	2,200	1,862	338
Watton	Glacial Gravel ..	2,431	1,675	756
St. Albans ..	Light Chalk, Medium Loam with flints, Glacial Gravel.	2,284	1,302	982
Eastwick	Boulder Clay ..	1,300	976	324
TOTAL ..		8,215	5,815	2,400

The largest increase in pasture has taken place on the lighter, poorer soil types. As far as the London Clay area is concerned, the bulk of the land has been under grass for many years and now practically all of it is grass.

The figures given below do not exaggerate the state of affairs. On the contrary, they are probably an understatement, because they have been obtained from farms, the occupiers of which are sufficiently interested in their grass-land to enter into competitions designed to stimulate interest in the improvement and management of grass land, and therefore they are more likely to have done something already towards the betterment of their grass.

Drainage. The position with regard to the need of drainage is brought out in Table III:—

TABLE III

District	Acreage	Considered to require Drainage	
		Acreage	Per cent. of Total
Barnet	2,200	890	40
Watton	2,431	292	12
St. Albans ..	2,284	114	5
Eastwick	1,300	208	16
TOTAL	8,215	1,504	18·3

The average amount of grass land in need of drainage is 18 per cent. Carslaw and his colleagues³ have estimated that

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14 per cent. of all the land in the Eastern Counties is in need of drainage, and arguing from this it would seem that generally grass land is as neglected in this respect as arable land. There is considerable variation according to soil type (also noted by Carslaw). Thus, 40 per cent. of the grass-land on London Clay and only 5-12 per cent. on the lighter soil formations requires to be drained. In all these areas, fields mole drained in the previous ten years are excluded. It must be noted also that three of the four years in which these data were collected were very dry, so that these figures may be said to represent land "badly" in need of drainage.

Lime. Soil samples were taken at random from each field and their pH values estimated colorimetrically. The results of these tests are set out in Table IV:—

TABLE IV

District	Total Acreage	Degree of Acidity, per cent. of Total Acreage				
		pH 7·0 and over	pH 6·9 to 6·1	pH 6·0 to 5·6	pH 5·5 to 5·0	pH 4·9 and under
Barnet ..	2,200	4·3	19·6	18·9	35·6	21·6
Watton ..	2,431	29·6	10·0	18·8	24·5	17·1
St. Albans :						
New Pasture	981	65·0	11·0	16·0	6·0	2·0
Old Pasture	1,302	10·0	6·5	22·0	46·9	14·6
Eastwick ..	1,300	76·3	6·1	6·3	5·4	5·9
Average ..	—	37·0	10·6	16·4	23·7	12·3

On the average, 37 per cent. of the grass land is not deficient in lime, 63 per cent. requires more or less lime and 36 per cent. (pH 4·9 to 5·5) is seriously acid. This condition, however, varies according to soil type and the age of the pasture. The percentage of sour grass land in the London Clay (Barnet) area is extremely high—no less than 95 per cent. of it having an acid reaction, over 57 per cent. being seriously acid. On the other hand, in the Boulder Clay (Eastwick) area, over 76 per cent. of the grass land is neutral or has a reserve of chalk, and only 11 per cent. is seriously acid. These figures show that the grass land of Hertfordshire is much more in need of lime than the agricultural land of the Eastern Counties as a whole, for which Carslaw and his

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colleagues⁴ estimated (without doing any chemical tests) "that one-fifth of the area is suspected as being deficient in lime."

That the newer areas are less likely to be seriously deficient in lime is well shown by the figures from the St. Albans area. Of the 2,284 acres examined in this area, 1,302 were old pasture and 981 acres new pasture. Of the old pasture over 61 per cent. of the acreage is seriously acid and of the 981 acres of new pasture only 8 per cent. are in that condition. These figures probably account in part for the higher palatability and feeding value and the better response to fertilizers on many new pastures compared with the old.

Another factor—and one associated with soil acidity—contributing to lack of productivity of old pastures is the degree of "mattiness." The figures given in Table V. emphasize the position in this respect of old and new pastures in the St. Albans area and of all pasture in the Eastwick area.

TABLE V

Degree of Mattiness	St. Albans Area				Eastwick Area	
	Old Pasture		New Pasture		All Pasture	
	Acres	%	Acres	%	Acres	%
Extremely Matted	391	30	Nil	Nil	143	11
Moderately Matted	690	53	108	11	533	41
Not Matted ..	221	17	873	89	624	48
TOTAL ..	1,302	100	981	100	1,300	100

The need for mechanical cultivation (or other means) to remove this "mat" is great, particularly on the older pastures. Obviously, where there is much "mat," wild white clover and the better sward-forming and more nutritive species will not be able to develop. Practically no mechanical cultivation was carried out on any of this grass land except light harrowing and rolling—operations grossly inadequate to deal with anything but a very light matted condition.

Use of Manures and Fertilizers. Table VI shows the extent to which manures and fertilizers have been utilized on the grass land. The figures refer to the manurial treatment the fields have had during the seven years before inspection, i.e., all fields that had no manure of any sort during this

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period are regarded as having had no manure and are included in the "nil" column. In the same way the other figures have been arrived at. Moreover, since the application of any manure or fertilizer (however small the amount) qualified for a place in the manured columns, it follows that the figures given do not necessarily mean that the manuring was suitable or adequate. In some instances the manuring was reasonably good (in one instance too good!), but in many it was quite inadequate and unsuitable, having regard to type of manure and price per unit.

TABLE VI

Area	Acreage	Percentage of Land Treated			
		Phosphates and Potash	Phosphates	Dung (or Pigs and/or Poultry)	Nil
Barnet ..	2,200	1	8	30	61
Watton ..	2,431	27	5	6	62
St Albans	2,284	42	5	4	49
Eastwick	1,300	27	15	3	55
Average ..	—	24·25	8·25	10·75	56·75

The table shows that on the average 24 per cent. of the grass land examined received phosphates and potash, 8 per cent. some phosphate, and a further 10 per cent. dung (either F.Y.M. or the droppings from pigs and poultry), while 56 per cent. was given no manurial treatment whatever. The amount and type of manure, however, varies from district to district, e.g., in the Barnet area (almost entirely a grassland area) little artificial fertilizer is employed and the farmyard manure available from the cowsheds is utilized on the grass land, usually on the hay portion. In each area there is a tendency on a number of farms to manure indirectly through the medium of grazing pigs and poultry, particularly the latter, but the total influence of this is small. There was practically no evidence of the use of lime on any of the grass land in any area. Grass land on which sheep were kept always looked better, i.e., greener and fresher, than where no sheep were kept.

Weed Flora. Table VII gives a summary of the main types of weeds found on the various grass land areas. All pastures contain more or less weeds and reference is made

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only to instances in which weeds were considered to be so plentiful as to be harmful to the productivity and quality of the grass. The weeds included are all non-gramineous; but in passing it may be mentioned that the plant population of much of the old pasture land, particularly the more acid fields, is made up of approximately 70 per cent. *Agrostis* spp. (Bents), 10 per cent. *Holcus lanatus* (Yorkshire Fog), 10 per cent. *Festuca ovina* spp. (Fine-leaved Fescue), plus traces of about 20 other species.

The term "broad-leaved weeds" refers to Plantains (*Plantago* sp.), Hawkweeds (*Hieracium* and *Crepis* spp.), Dandelion (*Taraxacum officinale*), and Daisy (*Bellis perennis*). They are grouped together as they seem to flourish under similar conditions and were generally found growing together. A glance at Table VII shows that these weeds are the most prevalent of the weed flora, particularly on the gravelly and lighter soils. Their prevalence appears to be influenced by soil fertility, soil type, climatic conditions and the management of the pasture. They gain access when a pasture is too closely grazed at the critical periods in dry seasons, and unless fertility is good and the grasses are allowed to recover, they remain and multiply.

TABLE VII

District	No. of Fields Inspected	Number of fields at each centre containing an excess of following weeds :						
		Thistle	Butter-cup	Nettle	Dock	Broad-leaved Weeds	Hard-heads	Sorrel, Rush, Tussock
Barnet ..	190			No	record	kept		
Watton ..	176	42	28	5	4	64	2	11
St Albans ..	196	12	12	3	2	58	2	2
Eastwick ..	116	11	25	4	—	18	—	5
TOTAL ..	678	65	65	12	6	140	4	18

Thistles (mostly *Carduus arvensis*) and Buttercups (*Ranunculus* sp.) were the next most important weeds. The number of times that Nettles (*Urtica* sp.), Docks (*Rumex* sp.), Hard-heads (*Centaurea nigra*), Sorrels (*Rumex* sp.), Rushes (*Juncus* sp.), and Tussocks (*Aira caespitosa*) were recorded was singularly small.

The figures for the three centres for which weed records have been kept have been further analysed in Table VIII to

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show the relative prevalence of weeds in old and new pastures. All weeds, with the exception of dock, are much more widespread in the old pastures. This is most notable with thistles and buttercups. Broad-leaved weeds occur plentifully in both types of pasture, though to a lesser extent in the new grass land. Old grass land is, on the average, also more prone to nettles, hardheads, sorrels, rushes and tussocks.

TABLE VIII

District	No. of Fields	Percentage of the number of fields containing excess of following weeds :						
		Thistle	Butter-cup	Nettle	Dock	Broad-leaved Weeds	Hard-heads	Sorrel, Rush, Tussocks
<i>Watton</i>								
Old Pasture ..	132	30.3	20.0	3.0	1.5	40.0	1.5	7.6
New Pasture ..	44	4.5	4.5	2.3	4.5	27.0	—	2.3
<i>St. Albans</i>								
Old Pasture ..	123	8.1	9.7	1.6	—	34.1	1.6	1.6
New Pasture ..	73	2.7	—	1.4	2.7	22.0	—	—
<i>Eastwick</i>								
Old Pasture ..	90	10.0	26.6	4.4	—	15.5	—	3.3
New Pasture ..	26	7.8	3.9	—	—	15.5	—	7.8
<i>Average, three Districts</i>								
Old Pasture ..	—	16.1	18.8	3.0	0.5	29.9	1.0	4.2
New Pasture ..	—	5.0	2.8	1.2	2.4	21.5	—	3.4

Rotational Grazing and Early Bite. Of the 67 farms visited in the course of these inspections, on four only was there an active attempt made to get better control of the grazing by dividing up the larger fields and grazing in rotation. Questions of fencing and water supply are not the only difficulties on many farms, for the taking of the animals to and from a special part of the pasture land twice a day involves much time and labour, unless the grass is near the homestead. Also, on only 4 out of the 67 farms was nitrogen used to secure an "early bite." It is evident that there is a considerable time-lag between the introduction and demonstration of new practices and their adoption on the average farm.

Summary. An account is given of the condition of 8,215 acres of grass land in four important grass land areas in Hertfordshire. It is shown that much of the land is in need

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of drainage; large areas are seriously acid and in a "matted" condition. Over 56 per cent. of the pasture is given no manurial treatment and much of the remainder is inadequately manured. Broad-leaved weeds are the most prevalent of the weed flora, but thistles and buttercups are also important. All weeds with the exception of docks are more prevalent on old pastures than new. On much of the seriously acid pasture, the plant population is made up chiefly of *Agrostis* spp., *Holcus* spp., and *Festuca ovina* spp. Rotational grazing and the taking of an "early bite" are practised on only a few farms.

ACKNOWLEDGMENT.—The writer wishes to thank his colleague, Mr. H. W. Gardner, B.A., for undertaking the pH tests of the soils.

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- ¹ An Economic Survey of Hertfordshire Agriculture, 1931 (Farm Economics Branch, Department of Agriculture, Cambridge, Report No. 18).
- ² Stapledon, R. G. : "The Land Now and To-morrow," 1935.
- ³ An Economic Survey of Agriculture of the Eastern Counties of England, 1931 (Farm Economics Branch, Department of Agriculture, Cambridge, Report No. 19).
- ⁴ *Ibid.*, 1933 (Report No. 22).

THE MINISTRY'S PUBLICATIONS

READERS of this JOURNAL during the last two or three years will be familiar with the annual reports on the work of the Education and Research Division of the Ministry, and will have noted that substantial sums are provided for the maintenance of research into agricultural problems and the provision of technical advice for farmers.

The real value of such research and experimental work depends largely, however, on the extent to which the results are made available to farmers and others concerned in a readily assimilable form.

One important means of bringing available information to the notice of farmers is the issue of various publications by the Ministry. Apart from this JOURNAL, these fall into four main classes—the Bulletins (priced), the Advisory Leaflets (single copies free), the Marketing Reports (priced) and the Marketing Leaflets (free).

The Bulletins, which are available at prices ranging from 3d. to 6s., may be regarded as treatises adequately covering the subjects concerned. Apart from one issue (No. 82), which is a technical bulletin intended for manufacturers and analysts, the Bulletins are written in simple language, so that the latest serviceable information on the subject dealt with is made readily accessible to the farmer or horticulturist. Most of the volumes are illustrated, and in some instances coloured plates have been provided.

Since the Bulletins were started on April 1, 1930, 98 have been published, in addition to a large number of new or revised editions and reprints. By the end of 1936 the total number of copies sold had reached the very satisfactory figure of 454,000—an average of approximately 65,000 copies per annum.

A complete list of the Bulletins and other publications of the Ministry may be obtained free of charge and post free from the Ministry, and from the Sale Offices of His Majesty's Stationery Office, and it is therefore unnecessary here to mention all the various subjects covered.*

Certain of the Bulletins, however, have proved very noteworthy, and it may be of interest to refer briefly to them.

Rations for Live Stock (Bulletin No. 48) was originally

* Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh, 2; 26, York Street, Manchester, 1; 1, St. Andrew's Crescent, Cardiff; 80, Chichester Street, Belfast.

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prepared in 1920 by the late Professor T. B. Wood. It describes a simple general method of working out rations for cattle, horses, sheep and pigs. The publication, which has since been extensively revised and brought up to date by Dr. H. E. Woodman, has proved extremely popular and has been regarded as a standard work from the outset. Nine editions have been necessary, and the publication is now in its 45th thousand.

Another Bulletin that has been in great demand is *Domestic Preservation of Fruit and Vegetables* (No. 21), prepared by the staff of the Long Ashton Research Station. The methods and recipes included can be carried out in any ordinary household. Four editions have been needed and over 23,000 copies have been sold.

Among the Bulletins of more recent origin, *Pig Keeping* (No. 32) and *Mushroom Growing* (No. 34) have sold to the extent of about 13,000 copies each, thus reflecting the interest commanded by the subjects concerned. *Tomatoes: Cultivation, Diseases and Pests* (No. 77), by Dr. W. F. Bewley, of the Cheshunt Experimental Station, has also been very successful and 8,000 copies have been sold. Within the last year or two Bulletins on *Herbs* (No. 76) and *Allotments* (No. 90) have been published, and reprints of each have already been necessary.

Every effort is made to provide advice on subjects that are attracting attention. For example, the increased demand for salads, and the tariffs imposed on imported produce, have enhanced interest in the cultivation of winter salads and early vegetables in frames. Bulletins Nos. 65 (*The Cultivation of Vegetables in Frames*) and 55 (*Salad Crops*) were accordingly issued.

The production of flowers for market is now an industry of considerable importance. To supplement the earlier Bulletins on *Narcissus Culture* and *Commercial Bulb Production*, further volumes on *Chrysanthemums* and *Commercial Flower Production* (Part 1—*Spring Flowers*) have been issued. A Bulletin on the production of summer flowers is now in preparation.

The important subject of poultry keeping has not been overlooked. The work of the National Poultry Institute at Reaseheath and Wye, on inbreeding poultry and on table poultry production respectively, is summarized in Bulletins Nos. 83 and 91. Other Bulletins deal with *Diseases of*

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Poultry (No. 6), *Scientific Principles of Poultry Breeding* (No. 7), *Housing* (No. 56) and *Culling* (No. 59). The whole range of poultry keeping, including turkeys, ducks and geese, is covered by one or other of the Bulletins.

Although not in the Bulletin series, mention may be made here of the "Land Drainage Act, 1930, Handbook." This collection in convenient form of the provisions of the Act is intended for the use of members and officers of Catchment Boards and other local authorities, but it should also be useful to the many landowners, land agents and farmers who may be concerned in drainage schemes. Over 2,500 copies of the Handbook have been sold to date.

Advisory Leaflets are brief, simply-written statements on subjects treated. Up to four copies in any one main group (e.g., Diseases of Animals, Manures, Insect Pests of Fruit Trees, etc.), with a maximum of 20 in all, are supplied free and post free by the Ministry. Copies of leaflets required in excess of these limits are obtainable from the Sale Offices* of His Majesty's Stationery Office—price 1d. each (1½d. post free) or 9d. net per dozen (10d. post free).

During the past seven years about 280 Advisory Leaflets on a wide range of subjects have been issued, and total free distribution has been in the neighbourhood of 1,200,000 copies. In addition, large numbers have been sold by His Majesty's Stationery Office.

To meet the wishes of readers who desire to have, in a convenient form, all the available leaflets on insect pests and diseases of plants, four collections have been issued in loose-leaf covers at a uniform price of 1s. 6d. per volume. New or revised leaflets may be obtained and inserted in these covers at any time. A similar collection, at the same price, includes all the leaflets on birds of agricultural importance.

Publications on Marketing. The main items of propaganda have been recipe books for housewives. The first of these publications—the National Mark Recipe Book—was published in 1934 and in all 400,000 copies were issued. This book was succeeded in January, 1936, by the National Mark Calendar of Cooking, issued free by the Ministry. This publication contains numerous recipes for each month, and each monthly section is prefaced by a list of National Mark

* Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh, 2; 26, York Street, Manchester, 1; 1, St. Andrew's Crescent, Cardiff; 80, Chichester Street, Belfast.

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products in season; 480,000 copies of the Calendar have been issued to date.

In addition to publications for producers and consumers, the Ministry has arranged during the past eight years for the designing of numerous posters and cards advertising National Mark products for display in retail shops. There has been a large and continuous demand for this display material.

Marketing Leaflets. These, which are supplied free of charge, are published in two distinct categories: (1) leaflets for the guidance of producers, and (2) leaflets of a propaganda nature and intended mainly for consumers. The former deal mainly with the National Mark Schemes and are of special interest to producers and distributors. The distribution of these leaflets is approximately 50,000 per annum.

The second series is distributed chiefly to housewives, and the leaflets are therefore couched in non-technical language. They set out briefly the object of the National Mark movement, and give details of the measures taken to maintain the national standards of quality required by the regulations. Apart from the National Mark Calendar of Cooking (mentioned above) the distribution of the marketing propaganda leaflets during the past twelve months has been as follows:—

	<i>Copies</i>
H.S. 1. What the National Mark Means	357,000
H.S. 2. National Mark Beef	306,000
H.S. 3. " " Creamery Butter	371,000
H.S. 4. " " Canned and Bottled Fruit and Vegetables	552,000
H.S. 5. " " Cheese	335,000
H.S. 6. " " Eggs	417,000
H.S. 7. " " Flour	401,000
H.S. 8. " " Fruit Juice Syrups	240,000

"Orange Books." The Economic Series of Reports, popularly known as the Ministry's "Orange Books," is mainly devoted to a study, commodity by commodity, of the technique of marketing of agricultural products. It also includes reports issued by Commissions appointed by the Minister to inquire into the possibilities of reorganizing the marketing of certain of the more important agricultural products, e.g. milk, pigs, eggs and poultry.

Up to the present 41 volumes have been published in the series. There has been a wide public demand for these books and 18 of the earlier volumes are now out of print. The total sales up to the end of December, 1936, amounted to nearly 238,500 copies.

COUNTY COUNCIL SMALL-HOLDINGS IN DORSET AND HAMPSHIRE*:

IV. POULTRY SMALL-HOLDINGS

EDGAR THOMAS, B.LITT., B.Sc.,

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IN view of the supposed adaptability of poultry for small-scale farming it is rather surprising that the number of specialist poultry smallholders in the two counties is not greater. The information here given is from 21 poultry holdings, all of which were in Hampshire. They were more or less concentrated in two groups, one in the neighbourhood of Fareham and the other at Pitt Corner some three miles west of Winchester.

The 21 holdings covered a total area of 150 acres; 11 holdings were less than 5 acres, 5 holdings were between 5 and 10 acres, and 5 holdings were over 10 acres.

Management. Each of the 21 holdings was predominantly concerned with poultry, and on 14 holdings there was no other enterprise. Of the other 7 holdings, 3 kept pigs, 2 had some market-garden crops, 1 had pigs and market-garden crops and 1 had a fruit orchard.

The total number of all kinds of poultry on the 21 holdings at the time of the survey was 14,675 made up as follows:—

6,942 hens and stock birds
6,110 pullets
1,513 chickens
70 ducks
40 turkeys

The following classification of the holdings according to the size of the poultry flocks gives a good indication of the size of the undertaking:—

Size of Flock	No. of Holdings
Under 200	1
200-400	6
400-800	6
Over 800	8

The most popular breed of poultry kept was the Rhode Island Red and its various crosses, but the following figures show that various breeds were kept:—

* Previous articles in this series appeared in the issues of this *Journal* for April, May and June, 1937.

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<i>Breed</i>	<i>No. of Holdings</i>
Rhode Island Red	7
Rhode Island × White Leghorns ..	5
Rhode Island × White Wyandotte ..	4
Game Cross	2
Sussex Cross	2
Rhode Island × Light Sussex ..	1
	—
	21
	—

The production of eggs was the main and almost only concern on 20 of the holdings; but, on 1 holding, the rearing of table birds was as important as the sale of eggs. All the smallholders reared their own birds, buying in new stock cockerels at regular intervals. Blood testing was done on 3 holdings. On most holdings the houses and runs were moved as regularly as possible on to fresh ground. The produce of 17 holdings was sold wholesale and that of 4 holdings retailed.

The greater proportion of the eggs sold wholesale were graded. Seven smallholders sent their eggs into Fareham market, where, for a small charge, the eggs were candled and graded and were subsequently sold by auction. As regards the other eggs wholesaled, the grading was done by the smallholders themselves, and the eggs were either collected by dealers or sold direct to shopkeepers. Grading was done by only one retailer, and he mixed his "specials" and "standards" because he found the housewife reluctant to pay the higher price for the better grade.

Capital Invested. Only 14 poultry smallholders were able to give financial data about their businesses. These data are presented in the following tables on a per acre basis in order to make them comparable with those already given for the dairy and horticultural holdings, but they are also given on the basis of "per layer" for purposes of illustrating the specific conditions of the poultry-keeper.

The average capital invested on all 14 holdings was £48 10s. 0d. per acre. This is a much higher figure than for either the dairying or the horticultural holdings, and may partly account for the different type of smallholder who seems to have been attracted to poultry keeping. The figure of £48 10s. 0d. per acre is equivalent to an investment of 12s. 3d. per layer, which is lower than the £1 per layer often given as typical of poultry farming. This lower figure is partly explained by the low valuation put on their buildings.

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by the smallholders, most of whom had constructed their own poultry houses. Of the total investment 56 per cent. was for poultry houses and 44 per cent. for poultry livestock.

Expenses. The average expenses per acre, per layer and per cent. are shown in Table XI.

TABLE XI
EXPENSES OF 14 POULTRY SMALLHOLDERS

Expenses	Per acre	Per layer	Per cent.
	£ s. d.	£ s. d.	
Rent and rates	5 6 9	0 1 5	10.0
Family labour	12 1 10	0 3 1½	22.6
Hired labour	3 4 8	0 0 11	6.0
Feeding stuffs	27 2 3	0 6 11	50.6
Livestock bought	1 14 9	0 0 5	3.2
Upkeep of buildings, etc. ..	2 6 6	0 0 6½	4.3
Other expenses	1 15 0	0 0 5	3.3
TOTAL	53 11 9	0 13 9	100.0

This table of expenses contrasts with the corresponding tables for the dairying and horticultural holdings in that labour does not appear as the biggest item of expense. On the contrary the purchase of feeding stuffs is easily the most important item, accounting for 50.6 per cent. of total expenses. Labour accounted for a further 28.6 per cent. of the total expenditure, but the bulk of this represents an estimated charge for family labour and, as such, did not involve an actual cash expenditure by the smallholders. The other items in order of importance were rent and rates, upkeep and repairs of buildings, straw, transport charges, oil and lighting, and disinfectants.

Receipts. Table XII shows the distribution of the receipts.

TABLE XII
RECEIPTS OF 14 POULTRY SMALLHOLDERS

Receipts	Per acre	Per layer	Per cent.
	£ s. d.	£ s. d.	
Eggs	45 8 8	0 11 8	74.7
Birds	13 4 0	0 3 5	21.7
Miscellaneous	2 3 4	0 0 7	3.6
TOTAL	60 16 0	0 15 8	100.0

COUNTY COUNCIL SMALL-HOLDINGS

The average total receipts of £60 16s. 0d. per acre include the value of eggs and poultry consumed by the smallholders' families. This amounted to an average of £9 6s. 4d. per holding, the average consumption per family being approximately 85 dozen eggs and 34 birds. In addition, 8 smallholders stated that they produced all their own vegetables and a further 2 a part of their own vegetables, but it was not possible to put an estimated value on these.

Receipts from the sale of eggs formed 75 per cent. of the total, and on all holdings, except 1, this was the major source of income. The over-all average egg yield per layer was approximately 9·5 dozens per annum. Of the total eggs sold 81 per cent. were sold wholesale and 19 per cent. sold retail.

Receipts from sale of birds were made up as follows:—
64 per cent. table birds, 28 per cent. culled hens, 5 per cent. day-old chicks and 3 per cent. cockerels. The sale of table-birds was important on 8 holdings, sale of day-old chicks on 3 holdings and of cockerels (to table-bird producers) on 2 holdings.

The unclassified receipts represent the sale of market-garden and fruit crops from 3 holdings, of poultry manure from 5 holdings and of pigs from 1 holding.

Profits and Losses. The average profit (i.e. excess of receipts and closing valuations over expenses and opening valuations) of the 14 smallholders amounted to £54 14s. 10d. per holding, or £6 12s. 8d. per acre or £0 1s. 9d. per layer. Of the 14 smallholders 8 showed a profit and 6 showed a loss, the exact position being as follows:—

	<i>No. of Holding</i>
<i>Profit of over £100 per holding</i>	3
£50-£100	4
" £25-£50 "	1
<i>Loss of less than £25 per holding</i>	2
" from £25-£50 "	1
" of over £50 "	3

When no charge was made for family labour all the smallholders, except 1, showed a surplus, the average "family" income being £154 10s. 0d. and the average income per person employed being £112 13s. 3d.

An examination of the individual results indicated that the most important influencing factor was the size of the flock, the chances of success being reduced as the size of the flock

COUNTY COUNCIL SMALL-HOLDINGS

was reduced. Thus of the 8 holdings having flocks of under 800 birds, 3 only made a profit, while 5 of the 6 holdings with over 800 birds appeared in the profit group. Again the average "family income" of the 8 holdings having under 800 birds was £75 14s. 0d., but for the 6 holdings with over 800 birds it was £268 15s. 0d.

V. MISCELLANEOUS HOLDINGS

Of the 28 miscellaneous holdings included in the inquiry, 24 were in Hampshire and 4 in Dorset. It is not possible to give very full details for these holdings, largely because of their heterogeneous nature. They may roughly be divided into 2 groups on the basis of acreage.

In the first group come 13 holdings under 20 acres each. On these market-gardening, fruit-growing or poultry-keeping play a more or less important part; but other enterprises such as pig-keeping or dairying were also of considerable importance and the holdings could not rightly have been included with any of the 3 main types already described.

In the second group come 15 holdings all over 20 acres. On most of these dairying was important, but other enterprises such as market-garden crops or pigs or sheep were of almost equal importance and the holdings could not rightly have been grouped with the dairying holdings.

Information about the systems of farming was obtained for all 28 holdings, but only for 9 holdings were financial data obtained. In view of the very mixed nature of the group it would be largely meaningless to present these data in the usual tabular form. It can be stated, however, that when family labour was charged for, 7 of the 9 holdings showed a profit, the average profit being £150 per holding or £6 13s. 4d. per acre. When no charge was made for family labour all 9 holdings showed a surplus income; the average "family income" was £262 and the average income per person employed was £166. These figures corroborate the impression formed at the time of the survey that this group of mixed holdings compared favourably with the more specialized types.

(Concluded)

CROP HUSBANDRY IN THE 18th CENTURY: BEDFORD, CAMBRIDGE AND HUNTINGDON

G. E. FUSSELL,

Ministry of Agriculture and Fisheries.

WRITING at the end of the seventeenth century, Meager was able to say of the group of three counties, Huntingdon, Cambridge and Bedford, that "in stiff clays, of which all the fruitful Valleys of the Kingdom are composed, as also in (these counties) and many others, all manner of Arable business must be begun early in the Year, and the Ploughs and Instruments to be used, made of the largest size, the Timber strong, and the Labour great and painful."¹* The soil of Bedfordshire is reported by Herman Moll not very much later, as being "generally fertil, producing all sorts of Grain in great Plenty, especially Wheat and Barley, which are not exceeded by any one County in *England*: and their Pastures feed very good Cattle, and they have great Dairies, but their Sheep deserve no very great commendations."² The wheat produced in the county was said to be the finest in the world in 1760, and it was much sought for as seed by farmers in other counties,³ one in particular being Northampton.⁴ The rotations changed from the conventional three-course open-field system even before inclosure, and Young reports courses of five crops at Wooburn in 1770, even longer courses elsewhere, and wheat, barley and turnips as fine as he had ever seen, in the Vale of Bedford, although he did not approve of the slow-moving, heavy ploughs drawn by three horses at length and the over-heavy sowing of beans.⁵ Owing, perhaps, to the backward state of inclosure in the county, Ernle complains that the county shared with Cambridgeshire "the reputation of being the Boetia of agriculture" at the end of the century,⁶ but on the open light lands the Norfolk course was followed in 1794 as well as in the enclosures, and in the open fields on the heavy lands a six- or seven-year course, including two fallows and some pulse was customary.⁷ It is true that the

* The list of references is given on p. 357.

heavy land was ridged up in the old curved ridges, seven yards wide, with deep furrows, but wheat was sown on two-thirds of the fallows, after they had been folded or treated with farmyard manure, and the ploughing was only 4 or 5 in. deep, but the farming was not entirely unimproved. Marl, chalk and lime were used as manure, and peat ashes and dust on the chalk lands, while the waste of London was also imported for the purpose.⁸

The farms in the county were not very large. Batchelar estimated that they were about 150 acres on the average. He thinks the number had diminished in the last 50 years of the century, but does not suggest consolidation as the cause of this. The system of tenure was generally from year to year, or for the three years' rotation on unenclosed land. There were, however, a few short-term leases.⁹ The implements had not changed much. Half the county still used the old flat wooden mouldboard plough, although an improved implement was used near Wooburn, and some gentlemen used the light Norfolk plough. The Duke of Bedford's bailiff used a plough with an iron mouldboard constructed on the principles set out by Bailey.¹⁰ Harrows were of the ordinary type, scufflers were not much used, there was little drilling and few machines, and Batchelar had never known a horse hoe used. There were, however, some rollers and a few threshing machines.¹¹ Some of the barley land round Dunstable was more turned to the cultivation of wheat at the end of the century.¹² Many of the modern implements had, however, their genesis in the county, owing to the Wooburn sheep shearings held by the Dukes of Bedford, for their surveyor from 1790 to 1821 seems to have been particularly fecund in this direction.¹³

Cambridge laboured under physical difficulties, particularly as regards the low-lying lands of the Isle of Ely, but as early as 1701, the south of the county was said to be fertile and well tilled, and to yield an abundance of barley, although the fertility of the soil was labelled "pretty fruitful" only, by the same writer at a later date. At the same time he says that the Isle had been improved by draining and the planting of sainfoin, while the county seems to have been as well known for saffron as Essex¹⁴; moreover, on the lands in the fens reclaimed by the process known as burn-baking, lucerne was grown, and one of Tull's pronounced protagonists was of the opinion that this must "certainly

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take effect if the Drill and Horsehough Ploughs succeed; the first of which will plant and cover the seed well, the second will help to keep the weeds down whilst the grass is young and tender, and in danger of being spoil'd."'¹⁶ Some of the barley grown was Bigg or Sprat barley, similar to that grown in Norfolk and Northampton.¹⁶

In 1739 Trowell suggested that there was a great deal of land in the Isle of Ely, Wisbech, Bedford, Lindsey Levels and parts of Lincoln of very little use for anything else, that might be devoted to producing hemp in order to avoid the necessity for importation,¹⁷ and this suggestion seems to have been acted upon, because hemp was "largely grown" in 1813, as was flax.¹⁸ The sheep of the county were fed on rape, which was grown in the Isle as well as in the lower parts of Cambridge and Huntingdon, and, if harvested for the seed, the edish was used for feeding.¹⁹

The process known as burnbaking was intimately bound up with the cultivation of rape. The soil was pared off 1 in. thick with a paring plough, stacked till dry and then burnt, the ashes being scattered as manure. Oats were then sown after one ploughing, followed by wheat, and then cole seed for oil or fatting sheep.²⁰ A great deal of the land on which this was practised had been made available for cultivation by draining operations. Young reckoned as much as 500,000 acres in the two counties of Cambridge and Lincoln,²¹ but the Cambridge fens²² were not esteemed so good nor so well drained as those of Lincoln, although the uplands, which seem to have been in large farms, were suited for turnips, and lime and dung were used as manure.²³

The farms in the county were, however, of a great diversity in size, varying from 20 acres to 100 acres, and although there were a few over 1,000 acres, yet many were between 100 and 1,000 acres.²⁴ Few leases were granted, and the feeling of insecurity this induced may have had something to do with any lack of progress there was in the farming.²⁵ The position as reported by Gooch, while showing that the old system of three courses, including a fallow, was general in the open fields, admits that the Norfolk system had been adopted in the enclosures, while heavy manuring was common in the higher land. There was no lack of forage crops, and some parts of the county had evolved a system that suited the type of land. Cambridge was one of the counties where potatoes were grown, if possible for the

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market, if not, for feeding. The implements were not greatly improved, the common foot plough being used in the Fens and the half or three-quarter Dutch plough, introduced into Yorkshire in the early part of the century, being used elsewhere in the county. Threshing machines were becoming general in 1813.²⁶

Huntingdon is another county, the cultivation of which was still in open field, in the main, at the end of the century, and it accordingly comes in for its share of blame from Ernle; and the fens were still some 44,000 acres in extent.²⁷ The higher land was arable and the highest sheep walk at the beginning of the century, the pasture then being spoken of well.²⁸ The arable was still in the high crooked ridges so often condemned by Young and other writers, and these were often a yard high. It was recommended that they should be ploughed from east to west to get the sun, and if the furrows were not deep enough the earth should be cleared out with a spade.²⁹ Young, however, speaks of the county in 1774 as one of those in which much open field land under the three-field system, "that vile course," had been inclosed and laid down within the previous 30 years.³⁰ The other counties where this had happened were, he says, Northampton, Leicester, and parts of Warwick and Buckingham. St. Neots was, however, a great corn market and the "vile course" must, therefore, in some circumstances, have been capable of producing a net gain that was saleable.³¹ In travelling from Harford to Branton and Huntingdon to Thrapston he found a long line of new enclosures, where the land was broken up for beans, followed by wheat, barley and clover.³² Again, 10,000 acres of the fens were under the alternate system in 1793, coleseed being sown after paring and burning with a breast plough or a paring plough from Holland, and followed by oats, wheat, and oats with seeds, and the ploughmen of the county were said to be the best in the world.³³ There were some parts under a four-course rotation, though the three-course was common. Moreover, the common swing and Dutch ploughs were giving way to a double-furrow plough, which had originally come from Calop, but was then generally obtained from Northampton.³⁴ A similar description of the county is given in the first report.³⁵ Parkinson goes into the matter in much greater detail, but does not add materially to our knowledge, though he does say that turnips were fairly general, and mentions

hemp and flax. The sheep fold and farmyard manure were the mainstay of manuring.⁸⁶ He is not, however, so emphatic about the double-furrow plough, having the general idea that types of the Dutch were mainly used, although others had been tried. Drills were used in several parishes and there were six threshing mills in the county.⁸⁷ There were some large farms, as we would expect from Young's statement that enclosure had led to depopulation in some parts,⁸⁸ but the small preponderated, and there were but few leases granted, those that were being only for short terms.⁸⁹

¹ *Mystery of Husbandry*, 1697, p. 68; ² *New Description . . .* 1724, p. 106—see also other topographers; ³ *The Farmer's Compleat Guide*, 1760, p. 21; ⁴ John Laurence, *New System . . .* 1726, p. 64; ⁵ *Northern Tour*, 2nd ed., 1770, I, pp. 21–50—see also *Museum Rusticum*, I (1766), p. 187; ⁶ *English farming past and present*, 4th ed., p. 241; ⁷ T. Stone, *County Report*, 1794, pp. 14, 21; ⁸ Thos. Batchelar, *County Report*, 1808, pp. 276, 279, 337, 358, 363, 388, 394, 398, 404, 411, 421, 427, 431, 434, 494, 495, 504, 510, 518; ⁹ *ibid.*, pp. 25, 27, 40, 41; ¹⁰ James Bailey, *Essay on the construction of the Plough*, 1795; ¹¹ *Op. cit.*, pp. 161, 162, 163, 165, 174, 177, 179, 190, 195, 196, 198, 211, 215; ¹² J. Baker, *The Imperial Jour.*, 1892, p. 4; ¹³ Sir E. Clarke, *Agriculture and the House of Russell*, Jour. R.A.S.E., 1891, p. 132; ¹⁴ Herman Moll, *System of Geography*, 1701, p. 25, *ibid.*, *New Description . . .* 1724, p. 161 (see also Samuel Simpson, *Agreeable Historian*, 1746, p. 78. Malachy Posthethwayt, *Universal Dictionary of Trade . . .* 1751, I, p. 436. *Cantabrigia Depicta*, 1763, pp. 2, 16. Stebbing Shaw, *A Tour in 1787*, p. 6); ¹⁵ Stephen Switzer, *A dissertation on the true Cythusus of the ancients*, 1731, p. 38; ¹⁶ W. Ellis, *New Experiments . . . for . . . April*, 1736, p. 6 ff.; ¹⁷ Samuel Trowell, *New Treatise of Husbandry*, 1739, p. 24; ¹⁸ W. Gooch, *Cambridge*, 1813, pp. 160, 167; ¹⁹ Trowell, *op. cit.*, p. 29; ²⁰ W. Ellis, *Modern Husbandry*, July, p. 34, also Gooch, *op. cit.*, p. 104; ²¹ *Political Essays*, 1772, p. 130; ²² see Ernle, p. 245; ²³ Charles Varlo, *New System . . .* 1770, p. 130, also Thomas Stone, *An Essay on Agriculture*, 1785, p. 119, ²⁴ Gooch, *County Report*, 1813, p. 32; ²⁵ *ibid.*, p. 38, Henry C. Taylor, *An Introduction . . .* 1905, p. 294; ²⁶ Gooch, *op. cit.*, pp. 47, 50, 95, 96, 98, 100, 119, 123, 133, 136, 138, 139, 141, 151, 153, 155, 160, 274; ²⁷ *op. cit.*, pp. 238, 244; ²⁸ James Beeverell, *op. cit.*, p. 142, and other topographers; ²⁹ John Mortimer, *op. cit.*, p. 47; ³⁰ *Political Arithmetic*, p. 148; ³¹ *Annals*, XVI (1791), p. 482; ³² *Annals*, VI (1786), pp. 454–455; ³³ *Annals*, XXI (1793), pp. 155, 156; ³⁴ *ibid.*, pp. 163–168, ³⁵ Thomas Stone, *Huntingdon*, 1793, pp. 9–13 (it is, of course, repeated by George Maxwell in his *Report*, 1794, pp. 8, 10, 17); ³⁶ *Report*, 1813, pp. 100–103, 116 ff., 122, 133, 136, 140, 150, 204, 211, 251 ff.; ³⁷ *ibid.*, pp. 32–35, ³⁸ *Annals*, VI (1786), p. 454 ³⁹ R. Parkinson, *Report*, 1813, pp. 41, 45.

COUNCIL OF AGRICULTURE FOR ENGLAND

The 48th meeting of the Council of Agriculture for England was held at the Middlesex Guildhall, Westminster, on Thursday, June 3, 1937. *Mr. Robert Bruford, J.P. (Somerset)*, was elected Chairman for the year, in succession to *Alderman G. E. Hewitt*. The Minister, the *Rt. Hon. W. S. Morrison, M.C., K.C., M.P.*, and the Second Secretary of the Ministry, *Mr. Arthur W. Street, C.B., C.M.G., M.C.*, attended on behalf of the Ministry.

The McCreagh Estate. *Mr. H. W. Thomas (Hants.)* asked whether anything had yet been done by way of acquiring the derelict estate in Hampshire. *Mr. George Dallas*, for the standing Committee, said that the matter was still before that Committee and had not been overlooked. It raised a very difficult and complicated problem and the Committee would ask the Minister to look at it again. At a time like the present, when we wanted to grow as much food as possible in the country, it was a public scandal that the estate should be left as it was. *Lord Selborne* agreed and said he had never been able to understand why the Ministry had been unable to deal with the matter.

Standing Committee. The Standing Committee of the Council for 1937 was elected as follows:—

For Landowners.—Lt.-Col. Sir Merrik Burrell, Bart., C.B.E.; Lord Cranworth, M.C.; Lord Eltisley, K.B.E.; Sir Arthur Hazlerigg, Bart., and Mr. Charles H. Roberts.

For Tenant Farmers.—Mr. Robert Bruford, J.P.; Mr. W. J. Cumber; Mr. Cecil Robinson, J.P.; Mr. Clement C. Smith, J.P., and Alderman R. L. Walker

For Workmen.—Professor A. W. Ashby, M.A.; Mr. George Dallas; Alderman G. E. Hewitt, J.P.; Mr. W. R. Smith, J.P.; and Mr. Denton Woodhead.

The Minister's Address. *The Minister* said he recognized the value of the Council in passing on to him and to those who assisted him experienced knowledge about agriculture. Agriculture was a vastly varied subject and it was very hard for one small head to contain all the requisite knowledge, and thus the Council and its Committee had been of great value to him.

He would this morning say something in explanation of the statement he had made in the House of Commons recently on the instalment of agricultural policy then announced. Since 1931 the Government had been attempting to deal with agriculture according to its most pressing needs caused by the collapse of prices in various commodities. Marketing schemes had been

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launched in rapid succession for such articles as pigs, milk, potatoes and hops. The work had been urgent and could not wait for a comprehensive policy. At the last meeting of the Council, he had been asked when he would produce a "balanced policy" for agriculture. That was a phrase which had been in many people's mouths and to which different people attached different meanings. What *he* meant by a "balanced" agriculture was the use of the land to the best advantage, having regard to the two limiting factors of soil and climate. If the land was not in good health and fertility, sufficient to yield its produce to the labour of the farmer, then any superstructure raised on such a foundation was bound to be defective. The proposals he had made the other day were intended to place a solid foundation under the schemes for individual commodities. He would make a few observations in fuller explanation of certain items of the policy.

Taking drainage first, since 1930 the Catchment Boards had been discharging their duties in the Catchment Areas with a marked measure of success. Works estimated to cost more than £6,000,000 had been approved and the situation had, no doubt, been bettered. The first step was to improve outfalls, after which, drainage could be carried further up the hills without fear that the extra water discharged into the valleys would prove a danger to agriculture and to life instead of a benefit. The present proposal was to extend the system of grants to internal drainage boards, and to local authorities where no drainage boards existed, in order that the streams which carry the water from the fields to the river might be cleaned out and improved. They would then be able also to carry the water which later improved field drainage might discharge into them. This was not subsidizing field drainage, though it should help its efficacy.

The next proposal was of a more novel character. It was the improvement of the fertility of the soil by restoring the ancient practice of applying lime to it. He was convinced that there was no one thing that could be done of more general benefit to fertility than liming. Much land was in a sour and acid condition and, if expensive fertilizers and manures were applied, it could not realize their full benefit because of the absence of lime. The Government, then, would offer a very substantial inducement, namely half the cost of the lime, to all those who knew their land was deficient in this respect and used that article for its improvement. As regards grass-land, the Govern-

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ment would similarly assist the application of basic slag, but the contribution would be one-quarter the cost of the fertilizer. It might be asked why the Government were assisting these two operations and not the application of superphosphate, sulphate of ammonia, etc., to the soil. The two reasons were that he was seeking (1) some lasting benefit to the land, and in this lime and slag had an advantage over other artificial fertilizers—though the value of the use of slag might not be so lasting as that of lime; and (2) that in spending public money it was necessary to see that it should be devoted to the purpose for which it had been approved. Both lime and slag were home-produced, and by co-operation with the home suppliers rises in price because of increased demand could be prevented. With superphosphate and other substances, however, we should have no control over the foreign exporter, who would dictate the price.

The Minister added that the other question upon which he would remark to-day was the last of the proposals included in his recent statement. It was the question of making a resolute attack upon disease in livestock. The losses from this cause were estimated at about £14,000,000 a year. Not only did disease afflict agriculture in actual casualties in animals, but it diminished their productivity and lessened their usefulness as wealth-producing elements. Strong measures had been taken in the past against disease and the great change now proposed was the centralization of the veterinary services. Complaint had been made that while some Local Authorities exercised their functions under the Diseases of Animals Acts and Acts relating to milk with great thoroughness, skill and enthusiasm, they were not invariably copied by their neighbours. It was a discouraging thing to a man who lived in one county where there was a high standard of efficiency to be asked to co-operate in regulations burdensome to himself in order to achieve eradication of disease, when the same burdens were not being placed on other farmers in the next county, the continuance of whose state was a frustration to his own improvement.

In order that the plan might succeed, the eradication of disease had to be tackled upon a nation-wide scale. The cost to the State of the present proposal would be £660,000 a year. Local Authorities would be relieved of about £170,000 a year by their officers being taken over, but there was no question that certain public health and allied functions would still require

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Local Authorities to maintain their committees. The Minister then gave some particulars of the negotiations that were going on with Local Authorities, the County Councils' Association and the Association of Veterinary Officers, adding that it was his intention to ask all whole-time Veterinary Inspectors of Local Authorities to join the new central service, subject to an age limit which, subject to Treasury sanction, would be interpreted as liberally as possible. The interests of Local Authorities and their staffs would be consulted and he was confident that willing co-operation between them would be forthcoming. The goal was worth striving towards, because, if only half the incidence of disease could be removed, it would be a very great boon to agriculture, which really could not afford the appalling wastage of stock now going on.

The Minister then mentioned the extension of the Wheat Act provision from 6,000,000 to 8,000,000 quarters a year, and the Government's aim at bringing in oats and barley where either of them and not wheat was the chief crop under cultivation. With regard to these other crops, what was wanted was rather an insurance against such disastrously low prices as they had suffered in recent years. It would be an acreage subsidy, limited to £1 per acre at the most, and the cost to the Exchequer could not be more than £1,750,000 a year.

In conclusion, the Minister said that these were very simple proposals. Their effect would be understood by the ordinary man who should be stimulated and encouraged by the belief that the Government desired to see an improvement in agriculture and its increased prosperity. Other problems at which he was working hard were milk and bacon and other items. He would not go through the whole list now but he hoped later in the session to announce details of other proposals.

Sir Merrik Burrell (West Sussex) congratulated the Minister on his proposals and on the clarity of his explanations. He was sure that already the farming world was perfectly confident that in our present Minister of Agriculture it had a real friend. Soil-health and animal-health were the two things chiefly aimed at, and, as the Minister said, they were the underlying fundamental things. In addition, it was necessary, where grass-land was concerned, to have it adequately grazed. That was where it was necessary to have a sufficiency of good animals to put on it. One of the difficulties to-day was to get sufficient well-bred stores.

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As regards the absorption of the county veterinary services by the State, he thought the County Agricultural Committees should back the Minister up in the wide policy he had adopted. He urged that no exception to the plan should be taken until Committees knew exactly what was intended. That would be known when the necessary legislation appeared.

Mr. W. R. Smith seconded the vote of thanks to the Minister. He referred to the "balanced" policy and called attention to the apparent lack of balance in the treatment of the labourer. It was necessary to keep the labourer on the land in a happy and contented position. To-day, the housing problem of the countryside made that very difficult. The labourer should be given housing conditions that would not only make him happy and contented, but would establish in his mind a desire to remain on the countryside rather than to drift to the town.

The Chairman here intimated that, before the vote of thanks was put, he would allow members to ask the Minister questions on his statement. Several were asked, the chief being on the use of chalk, the agricultural wage, the special schemes for barley and oats, lime, land settlement from distressed areas, housing and electricity for rural areas, the method of fixing the basic figures for wheat, barley, and oats, varying prices with the cost of production, and the fear that the subsidy on oats might reduce the market price for general sellers of oats.

The Minister, in replying, said he was grateful to Sir Merrik Burrell for mentioning the point that fertility of the land depended largely upon the livestock population. Liming and slagging were no substitute for livestock, and, as to the latter, the Livestock Industry Bill would do much to improve conditions. The Bill aimed at controlling the market and preventing the bottom being knocked out of it. The International Beef Conference had already met and had had a successful and auspicious beginning. The improvement in prices of livestock that had taken place recently was encouraging, and the farmers were paying good prices for store cattle to-day, which meant they had a certain confidence in the future. As regards housing conditions in rural areas, he regarded it as vital that these should be such as to attract young men to marry and settle down and live on the land. As agriculture improved, so the prosperity of the worker would tend to increase, and there had been some improvement in recent years. The wages were not the whole matter by any means, as many people preferred to live in the

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country on less money than in the town on more. He believed and hoped that something could be done to improve rural housing conditions. There was an Advisory Committee set up by the Minister of Health especially to consider rural housing, and there already existed the Rural Housing Act of 1926, under which much had been done in some counties and very little in others. He hoped that those counties that had hitherto done little would now see their way to use the facilities provided.

As regards electricity, the McGowan Report was still under consideration and the rural aspect of it would not be overlooked. Costs of production of cereals were variable things, depending on the weather, yield, and so on. He believed that the present proposals for wheat would make it remunerative under most conditions, and that those for oats and barley would provide insurance against disastrous disparity between costs and prices. Chalk would be regarded as within the scope of the liming proposals.

As regards the criticism that the subsidies for wheat, barley and oats ought to be available to the same man at the same time, the intention was that anyone who grew both oats and barley, or only one of them, and wheat should each year be able to elect which scheme of assistance he desired to use. He could choose between wheat and the other two crops each year. Consideration would make the justice of the proposals apparent. For example, barley was grown very largely in East Anglia, and, for a decent sample, the price was well above the range of the insurance proposals. It was the grower of feeding-barley who required the insurance against slump prices. The Wheat Act provided assistance for the growing of wheat, much more valuable to the wheat grower than the insurance against slump prices to the barley man. He would put the matter this way, that a greater output of wheat was desired and the Government framed the Wheat Act Scheme to insure it, but there were districts where farmers, through climatic conditions, were cut off from any participation in that national scheme. If, then, a man came under the Wheat Act, the Minister did not think he need complain too much because his brother farmer—higher up the hill under worse conditions—had the benefits provided for oats and barley.

Another point as to market prices; the Government intended to do its best to make sure that stable market conditions existed, but it was not the market price so much as the relation

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between costs and prices that was important. The Government intended to persevere along the line of making ample supplies of food available consistent with a reasonable return to the producer.

The vote of thanks was carried unanimously.

Marking of Imported Eggs: *Mr. W. B. Pinching (Middlesex)* moved:—

“ That the Minister of Agriculture be urged to take immediate steps to secure the effective marking of all imported eggs ”

Mr. Pinching stated that from 1930 to 1933 there was a considerable increase in egg production, though, since the last-named year, it had dropped back. He gave particulars of the production of eggs in this country and of the importation from foreign sources, showing how the latter had increased in recent years at the expense of the former. The law required eggs to be marked as “ Foreign ” or “ Empire ” or, alternatively, with the name of the country of origin. What happened to-day was that many imported eggs were ticketed “ New laid ” and were really preserved eggs, because one could not differentiate between preserved and fresh eggs in the case of importations. He had never seen a Chinese egg in this country sold as such, and was told that only dried eggs and eggs not in shell came from China. He did not find this borne out by the trade return, which showed that about 140,000,000 eggs per annum were imported from China in shells. He asked that the intention of the Merchandise Marks Act should be carried out and that eggs coming from foreign countries, if preserved, should be marked “ Preserved.”

Mr. Graves (Middlesex) seconded the Resolution, which was put to the Meeting and carried.

Wheat Act, 1932. *Mr. H. W. Thomas (Hants.)* moved:—

“ That in the opinion of this Council there should be no limit to the amount of home-grown wheat entitled to the full deficiency payment and that the standard price should be raised to 50s. per quarter.”

Mr. Thomas said he was glad to see the limit under the Act raised from six to eight million quarters, but he would better like to see the limit removed altogether and the standard price raised to 50s. a quarter. His reason was that there had been a large increase in the cost of production since 1932. The world price of wheat was high, and, if his proposals were carried out, there would be a greater run on wheat production,

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so that some of our worn-out pasture which had been let down could be ploughed up and returned to a useful purpose. Much of it might be got into condition to plant next autumn, and he thought the wheat would certainly be required, since the world wheat situation was none too promising. He also thought that this improvement of worn-out pasture and its return to grass after two or three years would bring an improvement to the cattle industry by the resulting ability to carry more and healthier stock.

Major Nelson Rooke seconded the Resolution on the ground that for national defence we should not limit our wheat acreage, and also because, if 45s. was the correct figure in 1932, then 50s. was a fairer figure now, having regard to the increased costs of production.

Lord Hastings pointed out the difficulty of dealing with this Resolution in proper perspective, apart from the requirements of barley and oats. He thought that if the prospect to the wheat grower was improved, it would be necessary to make that to the oat and barley grower also sufficiently attractive or the latter would be driven into wheat cultivation, which he gathered was not desired. Indeed, the argument for a balanced agriculture was lost the more one particular kind of crop was subsidized. He thought this point should be borne in mind, but he supported the Resolution. *Alderman T. Byass* agreed with the last speaker and said for that reason he could not support 50s. a quarter.

The Minister said there was no limit of acreage for wheat growing under the Act, but the yield, which was limited for subsidy purposes, was being raised by one-third, i.e., from 6,000,000 to 8,000,000 quarters, and in none of the years since the passing of the Wheat Act had this figure been reached. The question of an alteration of the standard price was foreseen in the Wheat Act, which required a committee to be set up not later than 1935 to consider it. This committee, under the chairmanship of the late Sir John Beale, had been set up and had reported in 1935 that there should be no alteration in the standard price. It would not now be desirable to undertake the responsibility of raising the price without another such investigation as the Act itself foresaw as necessary. He thought that farmers would agree that the additional insurance of getting 45s. for their wheat was a very good inducement in these days when prices were so apt to vary. He did not, however, wish to oppose the motion, but thought

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the Council should have these observations in order to see that the question of raising the standard price was not so simple as it looked.

Mr. Charles Roberts asked whether this question had been considered from the point of view of requirements for national defence. *Sir Arthur Hazlerigg* suggested that the matter should be referred to the Standing Committee for consideration and *Mr. D. G. Watkins* seconded that. *The Minister* said that the matter had been considered from the point of view of national defence and what the Government wanted to see was that such wheat as could properly be grown should be grown, and he thought that the proposal he had made would ensure that result. It was then put to the Meeting and agreed that the resolution be referred to the Standing Committee.

Beef Prices. *Sir Arthur Hazlerigg* presented the Report of the Standing Committee on the question of Beef Prices and the Subsidy (see Appendix I, p. 369). He said that the Report was a very restrained one, and confined itself almost entirely to a statement of actual facts. He commented on various statements in the Report, adding that the Minister was "flirting" with a standard price for oats and he (Sir Arthur) hoped that it would come to a standard price for beef in the end.

Mr. T. C. Ward (Salop) said that the Report was merely a recital of facts and there was not a single recommendation in it. He would move that it be referred back to the Standing Committee. *Mr. J. V. Wheeler (Salop)* seconded. *Alderman E. Peat (Derby)* asked whether anything could be done to remove the taxation on the importation of Irish steers. *Mr. Hewitt* said that he agreed with Sir Arthur Hazlerigg that stabilization of prices for steer beef was required. He would not have it applied to cow beef. Under the pressure towards greater milk production there were more fat cows brought to market than formerly. Fattening steer beef meant more manure for the land. *Mr. John Beard* asked if something could not be done to give a guarantee to steer beef. He thought that Londoners to-day got mainly cow beef. *Mr. J. O. Adams (Northants.)* asked about encouraging the rearing of young stock. Milk, at the manufacturing price, ought to be used to feed calves, and he hoped that people rearing young stock would be able to retain some of their milk for that purpose at the manufacturing price. *Sir Arthur Hazlerigg* here suggested that, if the mover and seconder of the amendment agreed, the

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Report might be received as it stood, and a rider added that the Standing Committee be instructed to consider further the question of a satisfactory policy for beef. That was agreed, and the Report adopted.

Cheaper Milk Schemes. *Mr. George Dallas* moved the adoption of the Standing Committee's Report on the subject of increasing the consumption of milk by the extension of the Cheaper Milk Schemes already operating (see Appendix II, p. 370). *Mr. C. H. Roberts* said that the object was eminently desirable, but not so easy as it looked. Milk-producers did not like the idea of a retail price of 1s. 4d. per gallon for their milk. He did not think they realized that it was better for them to get 8d. a gallon for milk on a cheap scheme than 5d. a gallon for manufacturing milk. The milk-producer was rather afraid that the schemes would lower the total amount coming to him, but *Mr. Roberts* did not agree. He held that, from the national point of view, it was vitally necessary that the price of milk to the consumer should come down. At present prices, for three children in a family to get the recommended amount of milk it would cost the family about 9s. a week on milk alone. That was far too much. He desired also to emphasize the sentence in the Report which invited the co-operation of Local Authorities, because some of them were inclined to feel that they should not take the trouble. These said "It is the Milk Marketing Board's job; that Board would apparently make something out of it, and why should we have to fill up complicated forms, &c." He thought, therefore, that, if these schemes came into force, the simpler they were and the less burden that was thrown upon the Local Authorities, the better. The Report was adopted.

Expenses of Worker Members on County Agricultural Committees. *Mr. W. R. Smith* moved the adoption of the Report on payment by Counties, etc., of the expenses of worker members on County Agricultural Committees (see Appendix III, p. 373). The Report was adopted.

Field and Tile Drainage. *Mr. R. Anderson (Northumberland)* moved:—

"That the Council of Agriculture considers that as a means of alleviating unemployment and improving agricultural land, the Ministry of Agriculture and Fisheries be urged to restore the grants which ceased to be made in respect of field and tile drainage schemes in England in 1931; and that it be pointed out to the Ministry that grants are still being made in respect of similar schemes in Scotland."

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Mr. Anderson said that there were hundreds of acres in Northumberland and thousands of acres in the country that required proper arterial drainage. Tile drainage was the most effective and lasting if the drains were put in at suitable depths, but it was expensive, costing anything from £15 to £20 per acre. The Minister had mentioned the health of stock. Many of our sheep diseases were attributable to grazing on wet land. He considered that public money spent on field drainage would safeguard a vital asset. It would give plenty of work during the winter months. The Minister's proposals as regards drainage would appear to be made only in respect of the drainage schemes which would be carried out by drainage authorities. There were no such authorities functioning in Northumberland and grants for field drainage were being made over the border, in Scotland, and none in his own county. *Mr. Briggs (Soke of Peterborough)* seconded. He welcomed the words of the Minister that his scheme included the clearing out of dykes and sewers in an effort to get rid of surplus water. That would obviate, in many instances, the complaints now being made by County Agricultural Committees that water was being held up. The people in his district had realized that dykes had to be cleaned out. Everybody knew that potatoes standing in water for twenty-four hours were finished.

Mr. Roberts asked whether the announcement was that local authorities would have grants for cleaning out dykes and streams in areas where there were no internal drainage boards. An answer was given in the affirmative. *Mr. Roberts* then asked whether it was not possible to go further and restore the grants for field and tile drainage so that there would be no discrimination between the farmers of Northumberland and Cumberland and those of South Scotland. *Mr. T. C. Goodwin (Cheshire)* and *Mr. E. F. Brewis (Northumberland)* spoke in favour of outfall drains being cleaned.

The Minister said that, inasmuch as the problem of drainage in Scotland was different from that in England and there was very little arterial drainage in Scotland owing to the generally high level of the country, Scotland had received grants for field and pipe drainage, while England had had the benefit of the money for the drainage of the main rivers by Catchment Boards. It was not proposed to give grants for field drainage in England and Wales, but to extend grants to Internal Drainage Boards and to Local Authorities for the purpose of

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clearing out the lesser streams and thus making field drains effective. The grants would also cover boundary dykes or minor water-courses. The grants would be available to County Councils where no internal drainage boards existed. *Mr. Matthews (Hereford)* advocated helping mole drainage. The Resolution was then put to the Meeting and carried.

Appendix I.

Report from the Standing Committee on the present position as regards Beef Prices and the Subsidy.

1. The Standing Committee has, from time to time during the last eight or nine years, presented reports to the Council on the state of the livestock industry in this country. In May, 1932, the Committee called the Council's attention to the very serious position which had arisen in the industry through the falling away of the wholesale prices of beef, veal, mutton and lamb. Then, the cost of store cattle one and two years before, when the animals had been taken on the farms by the feeders, was high, and farmers found, on sale of the finished animals at lowering prices, that they had been producing at a loss. Prices still further declined and farmers, always hoping for better prices, which never materialized, continued to produce at a loss until the subsidy of 5s. per live cwt. for fat cattle was brought in, in 1934. In many parts of the country, even with the subsidy, fat cattle have since been only able to be produced by farmers trenching on capital or going into debt. There is, at the present time, a likelihood of improvement in this respect, as the prices of fat cattle are to-day somewhat higher, though in our view, remembering also the increases in costs of production, to some of which we refer later, they have not yet reached a point at which, with the subsidy, they can be considered as giving more than a scanty return to the average producer.

2. To realize the position more clearly the following facts and figures from official sources are set out: in 1932, the average annual price of first and second quality fat cattle (shorthorns) in England and Wales amounted to 42s. 2½d. per live cwt., representing a decline of about 12 per cent. compared with the annual average for the period 1927-31. In the next three years, a further severe fall occurred, the average price, excluding subsidy, in 1935 showing a fall of 30 per cent. as compared with the period 1927-31. Prices in 1936 showed a slight recovery, but the average for the year, excluding subsidy, was still nearly 27 per cent. below the 1927-31 average, excluding subsidy, or 16 per cent. including it.

3. So far this year—and especially in recent weeks—there has been a further improvement in fat cattle prices which appears to represent somewhat more than the seasonal increase which normally occurs in the first half of the year. For the first quarter of 1937, the average price of first and second quality fat cattle (shorthorns), including subsidy, was 41s. 2½d. per live cwt. as compared with 39s. 10d. per cwt. in the first quarter of 1936 and 48s. 6d. per cwt. in the corresponding quarter of the quinquennium 1927-1931. But it is doubtful whether producers of fat cattle have so far benefited to any appreciable extent by the increase, because of the sharp rise in the prices of purchased feeding stuffs which has accompanied it. In the first quarter of the present year, the Ministry's index of feeding stuffs prices was 117, representing a rise of 33 points as compared with the corresponding quarter of last year. In fact, producers who rely on purchased feeding stuffs are now, for the most part, paying

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prices appreciably higher than those ruling in 1932, although fat cattle prices, exclusive of subsidy, are about 15 per cent. less than in that year.

4. If the official index numbers of cattle prices are compared with those of other agricultural commodities, it will be seen that the cattle industry is still one of the most depressed branches of agriculture. In March this year, the Ministry's index of fat cattle prices was 102 (without subsidy), whereas fat sheep stood at 145, pork pigs at 124, bacon pigs at 122, and the general index for all agricultural products at 130. After full allowance is made for the effect of subsidy payments, the index for fat cattle stands only at 117 for March. For April the corresponding figure is 120, and so far as the present month is concerned prices are still slowly rising.

5. The Committee would, then, sum up the situation by saying that the industry has, for some years past, been suffering under great difficulty, and that it is a fine testimony to the hardihood of the livestock feeder that he has been able to maintain himself in the face of adverse marketing conditions. Some recompense in the form of a period of stable remunerative conditions is certainly due to him.

6. The Livestock Industry Bill proposes that a sum of not more than £5,000,000 shall be available in any one financial year to assist the livestock farmer by means of payments of approved rates of subsidy on the sale of fat stock. The Committee considers that in deciding on the rates of assistance for future years, such facts as those set out above should be taken into careful account. Further, the Committee is definitely of the opinion that the £5,000,000 provided in the Bill is not likely to be more than sufficient, if it is sufficient, to give the necessary help to the industry in the first year of what we hope will be the beginning of a better period for a much harassed and impoverished branch of home farming. Whether it will prove sufficient for all years in the future will depend on the levels of prices and costs of production and remains to be seen.

Appendix II.

Report from the Standing Committee on the question of increasing the Consumption of Milk by the extension of the cheaper milk schemes already operating.

PART I.

1. The Standing Committee's report to the Council on the subject of increasing the consumption of milk, dated June, 1936, commented upon the outstanding merit of Milk as a food containing all materials essential for the growth and maintenance of life in a form ready for utilization by human beings, and drew attention to the evidence in this respect published in a memorandum on "The Nutritive Value of Milk" by the Advisory Committee on Nutrition appointed by the Ministry of Health. Since that report was issued, this Advisory Committee has issued its First Report, to which the Committee now draws the Council's attention.

2. The Report deals with food in general and refers, in its comments on recent advances in the study of nutrition, to the essential need for correct feeding in the case of expectant and nursing mothers and young children; the younger the child the more important it is that it should be properly fed, for the effects of a dietary deficiency during childhood or adolescence may persist through life. In its remarks on milk, the Report compares the present consumption per head with the nutritional requirements suggested by the Technical Commission of the League of Nations Health Organization. It finds that, whereas the requirements suggested by the Commission are equivalent to an average daily allowance per head of

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seven-eighths of a pint, less than one-half this amount is estimated to be consumed per person in this country. If condensed and dried milk are included the national consumption is still only 60 per cent. of the amount suggested by the Commission. The Advisory Committee states the desirable amount of milk for children to be from one to two pints per day, for expectant and nursing mothers about two pints per day and for other adult members of the community about one-half pint per day. It deplores the fact, therefore, that while the volume of milk offered for sale is growing and there is a substantial surplus on the market, there is, at the same time, "a severe deficiency of milk in the diet of large sections of the population."

3. The Standing Committee sees no escape from the conclusion that steps should be taken to remedy this position either by a drastic reorganization of the methods of distribution which would enable an all-round reduction in the price of milk to be effected or by a considerable extension of the schemes for the supply of cheaper milk to special classes, or by both methods.

PART II.

4. At the last meeting of the Council, the following resolution by Major Nelson Rooke was referred to the Standing Committee for consideration and report :—

"That the Council of Agriculture for England is of the opinion that the Government should be asked to take immediate steps to ensure that any so-called 'surpluses,' i.e., amounts of agricultural produce grown in excess of ordinary requirements, shall be diverted, without loss to the producer, to any needy section of the population, such as those in receipt of National Health Insurance, Unemployment Relief or other form of public assistance, as, in the interests of food production against an emergency, of proper nutrition for the under-fed and of the agricultural industry itself, it is essential to stimulate production in this country."

5. The Committee has carefully considered Major Nelson Rooke's suggestion and agrees that, wherever foodstuffs are grown surplus to ordinary market requirements, it would be an undoubted advantage to the community if workable schemes could be devised whereby the surpluses could be dealt with as suggested, and not permitted to swamp the market so that the price for the whole crop or production is lowered beneath a profitable price to the producer. The Committee considers that the few commodities which would lend themselves to the treatment suggested are to be found amongst those that are the subject of marketing schemes and as to which the amounts of the comparable imports are known or can be foreshadowed. Only in respect of such can it be stated with reasonable accuracy how much, if any, of the crop or production in any particular year is surplus to ordinary market requirements.

6. Whatever commodities come within the purview of such schemes, milk is clearly one and outstandingly deserves first consideration. It is entirely home produced and there is always a large surplus to ordinary liquid milk sales. The Committee decided to restrict its examination to this commodity in the first instance, and to deal only with the question of the extension of existing schemes for the sale of milk at cheaper rates than those ordinarily in operation.

7. The schemes already existing are the Milk-in-Schools Scheme and those at present in force through the co-operation of the Milk Marketing Board, the Commissioners for Special Areas, the distributors and the local authorities in the distressed areas, particularly in the Rhondda Valley.

8. The Rhondda Valley scheme was started in July of last year and its object was to sell additional milk for special classes in families, namely,

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for expectant and nursing mothers and children under five years of age, at 2d. per pint, i.e., 1s. 4d. per gallon. Under the authority of the Medical Officers of Health, persons in these categories are allowed one pint daily at the reduced price, though the allowance can be increased on the recommendation of the M.O.H. who can approve either raw or pasteurized milk or both. There is no income test and no reference is made to the financial status of the applicant. Dairymen approved for supplying the special categories under the scheme are allowed 8d. a gallon as a distributive margin.

9. The effect of this and similar schemes in distressed areas now operating appears to be that more milk is sold, the distributor deals with larger quantities and does not lose money, and the producer gets a somewhat better price for it than he would if the milk were sold for manufacture.

10. The Standing Committee suggests that, since these schemes have been successful in bringing more liquid milk into consumption, they should be extended to similar classes throughout the country, the local authorities and the Medical Officers of Health being invited to co-operate in this national work. The Milk Marketing Board on behalf of all milk producers has already shown its active interest in such schemes, and the Government would no doubt be ready to assist in any way which it deemed to be advisable and equitable. It might be necessary to apply an income test to recipients as it is essential that the cheaper milk should go to the really needy classes and be in addition to and not in substitution of existing supplies. With such recipients the present average consumption of milk would be likely to be low, and, therefore, supplies of cheaper milk, especially if accompanied by conditions as in the case of the Rhondda Valley supplies, are likely to be taken as additions to the present consumption. If thought advisable and practicable, needy cases amongst the unemployed and old-age pensioners might also be dealt with, possibly with slight variations of the scheme to meet special cases.

11. Apart from this proposal, it appears to the Standing Committee that there is ample room for advance on the lines suggested by the Re-Organization Commission of Milk Marketing Schemes in Great Britain of supplying factory workers, mine workers and even large office staffs with cheaper milk during working hours. Where all the recipients are under one roof, the distributors may find themselves able to accept a margin of 6d. per gallon, as in the case of school milk; and, since this milk would not be in competition with household supplies, but would otherwise be sold for manufacture, it might be supplied to the distributor for sale at 1s. 4d. per gallon. This would enable workers to purchase milk delivered at a suitable time at their place of work at 1d. per half-pint.

12. The Committee would repeat the suggestion put forward by the same Commission that there might also be sales of cheaper milk from selected shops or depots for those people who were prepared to send for it. It is not reasonable that the purchasers who are prepared to do without the services of an expensive distributive system should be charged the same as others who require milk delivered at their door twice or thrice daily. It was suggested by the Commission that these special shops could be supplied with milk at a lower rate than that to ordinary distributors, and that they should be tied to a low retail price and to sales over the shop counter. If such a scheme were introduced, it would be of especial advantage in areas where the consumption of milk is already low, so that there would be a good chance of a largely increased consumption of milk resulting therefrom. Here, again, the Standing Committee would like to see a retail price of 1s. 4d. per gallon for milk sold from those shops.

13. It will be realized that, in making the above suggestions, the Standing Committee is putting forward very little that is new. It is

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rather bringing several proposals together : (a) for the extension of existing schemes which have met with a measure of success, and (b) for the inauguration of schemes suggested in reports by *ad hoc* Committees and Commissions, whose views should have much weight. If this can be done, considerable advance would be achieved in the direction of utilizing the surplus liquid milk for the good of the community and the benefit of the producer.

14. In conclusion, the Standing Committee would repeat the words of the Advisory Committee on Nutrition in their First Report mentioned at the opening of this Report : " The national advantages of an improved standard of health for the rising generation cannot be expressed in pounds, shillings and pence ; but even from the point of view of industrial efficiency, it is not over-stating the case to say that a high general standard of physical well-being is the nation's greatest asset." The Report continues : " From the health standpoint, there is no single measure which would do more to improve the health, development and resistance to disease of the rising generation than a largely increased consumption of safe milk by mothers, children and adolescents."

Appendix III.

Report from the Standing Committee on the subject of Payment by Counties, etc., of Expenses of Worker Members of County, etc., Agricultural Committees.

1. At the last meeting of the Council of Agriculture (December 10, 1936) a resolution was passed on the motion of Mr. John Beard, as follows :—

" That this Council of Agriculture calls the attention of the Government to the difficulty of securing labour representatives on many County Agricultural Committees owing to County Councils declining to make financial provision to meet the needs of the labourers for travelling, subsistence and loss of pay ; and asks the Government to remedy this defect in the Act either by itself, or through instructions to County Councils to make such financial provision as will make it possible for labourers to give their quota of service."

2. The Standing Committee has looked into this question and finds that local authorities have power only to pay travelling and subsistence allowances, not loss of pay. It is, moreover, informed by the Ministry of Agriculture that the matter has been taken up with the fifteen County and Borough Agricultural Committees which had, at the date of the Council meeting, made no effective provision for the payment of travelling expenses or subsistence allowances to members generally or to those representing agricultural labour, with the following result : six of the agricultural committees have come into line, and there is a likelihood of four others doing so, leaving only five authorities in England and Wales at present apparently indisposed to make any change in the practice they have followed in this matter in the past.

3. The Committee considers that it is to be regretted that these five authorities have come to a decision adverse to the spirit of the Council of Agriculture's resolution, as set out above. It suggests that these bodies should now reconsider the proposal, bearing in mind the fact that other committees have agreed, and that out of 68 such authorities set up in England and Wales under Part 3 of the Ministry of Agriculture and Fisheries Act, 1919, only five have declined to adopt the course recommended.

4. The Committee sees no reason why there should not be absolute uniformity in the practice of County and Borough Agricultural Committees in the treatment of its members who are chosen to do public work and freely give their time and experience for the benefit of their fellows.

MARKETING NOTES

Milk Marketing Scheme. Pool prices and rates of producer-retailers' contributions for May, 1937, are given below, with comparative figures for April, 1937, and May, 1936. The monthly wholesale liquid milk price was 1s. 0½d. per gallon, the same as for the corresponding month last year. The ½d. represents the purchasers' contribution towards a publicity fund; a similar contribution is made by producers by an allocation from the Board's funds.

	<i>Pool Prices</i>			<i>Producer-Retailers' Contributions</i>		
	<i>May</i> 1937 <i>d.</i>	<i>Apr.</i> 1937 <i>d.</i>	<i>May</i> 1936 <i>d.</i>	<i>May</i> 1937 <i>d.</i>	<i>Apr.</i> 1937 <i>d.</i>	<i>May</i> 1936 <i>d.</i>
Northern	9½	12½	8½	2½	3½	2½
North-Western	9½	12½	8½	2½	3½	2½
Eastern	9½	12½	9	2½	2½	2½
East Midland	9½	12½	8½	2½	3½	2½
West Midland	9	12½	8½	2½	3½	3
North Wales	9	12½	8½	2½	3½	3
South Wales	9½	12½	8½	2½	3½	2½
Southern	9½	12½	9½	2	2½	2½
Mid-Western	9	12	8½	2½	3½	3
Far-Western	9	12	8½	2½	3½	3
South-Eastern	10	13	9½	1½	2½	2½
Unweighted Average	9·30	12·45	8·80	2·34	3·16	2·78

These prices are exclusive of any premiums for special services and level deliveries, and also of the accredited producers' premium of 1d. per gallon.

The accredited premium was paid on 34,446,193 gal., and the sum required for the payment of the premium was equivalent to a levy of ½d. per gal. on pool sales.

The inter-regional compensation levy was fixed at 1½d. per gal., compared with 1½d. per gal. in May, 1936.

Sales on wholesale contracts were as follows:—

	<i>May, 1937</i> <i>(estimated)</i>	<i>May, 1936</i>
	<i>Gallons</i>	<i>Gallons</i>
Liquid	49,730,968	48,031,378
Manufacturing	39,352,145	42,531,859
	<hr/> 89,083,113	<hr/> 90,563,237
Percentage liquid sales ..	55·83	53·04
Percentage manufacturing sales	44·17	46·96

The average realization price of manufacturing milk during May was 5·53d. per gal. compared with 4·92d. per gal. for

MARKETING NOTES

May, 1936. The quantity of milk manufactured into cheese on farms was 2,946,687 gal., compared with 1,323,449 gal. in the previous month and 2,642,717 gal. in May, 1936.

Regional Elections. Elections of Regional members took place in three Regions on June 5. Mr. J. W. Rickeard, the retiring member, was returned unopposed for the Eastern Region, and Messrs. F. Jackson and C. T. Sproston, and Mr. J. Garton, retiring members, were re-elected for the North-Western (two vacancies) and South-Eastern Regions, respectively.

Annual General Meeting. The Fourth Annual General Meeting of registered producers was held on June 10, 1937. The retiring special member of the Board, Mr. T. Baxter, was re-elected. The Board presented to the meeting a Report on the working of the scheme for the year ended March 31, 1937, together with a Statement of Accounts. According to the Report, the number of producers selling milk by wholesale on March 31, 1937, was 84,610, compared with 81,984 on March 31, 1936—an increase of 2,626 or 3.2 per cent. During the same period the number of contracts registered with the Board increased from 88,510 to 91,588, i.e., by 3,078 or 3.5 per cent., while the number of licensed producer-retailers declined from 65,786 to 64,846, i.e., by 940 or 1.4 per cent.

The total quantity of milk sold under the scheme, compared with the two previous years, was as follows:—

	<i>Thousands of Gallons</i>		
	1936-37	1935-36	1934-35
Sold by wholesale under contract ..	883,612	868,386	783,424
Producer-retailers' sales	105,964	103,699	105,941
Farmhouse cheese-makers' sales ..	18,274	15,182	21,319
Milk for schools sold direct by producers	4,032	4,046	2,017
Total quantity of milk passing through the Board	1,011,882	991,313	912,701

The respective quantities of milk sold in the liquid and manufacturing markets were:—

	<i>Thousands of Gallons</i>		
	1936-37	1935-36	1934-35
Liquid	669,372	656,775	650,452
Manufacturing	342,510	334,538	262,249
TOTAL	1,011,882	991,313	912,701

MARKETING NOTES

It is of interest to note that liquid sales accounted for 61 per cent. and manufacturing sales for 39 per cent. of the total increase in 1936-37, as against 8 per cent and 92 per cent. respectively in 1935-36.

There are 1,070 farmhouse cheese-makers' contracts in operation this year, compared with 963 a year ago, showing an increase of 107, while the average grant payable to farmhouse cheese-makers was 4.58d. per gallon, compared with 4.35d. per gallon last year.

The Board have extended their manufacturing facilities by alterations and additions to existing buildings and plants and by the acquisition of new premises. At the end of the financial year the Board were operating ten creameries; the number a year ago was five.

Hops Marketing Scheme. The retiring district members of the Hops Marketing Board have been re-elected for a further year. At a meeting of the Board on April 23, Mr. W. J. Woolrich and Mr. G. H. Edwards were re-elected Chairman and Vice-Chairman respectively.

The estimated market demand for hops for 1937 has been fixed at 222,500 cwt., as compared with 225,000 cwt. for 1936, and the total of annual quotas at 98 per cent. of basic quotas, as against 100 per cent. for 1936. Interchange of annual quotas for the 1937 crop will be permitted until October 7, 1937.

The latest date for tendering to the Board hops of the 1937 season is October 6, 1937.

Cattle Fund. The following table gives particulars of payments made under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936.

	Payments	Animals	Average Payment per Animal
	£		£ s. d.
April and May, 1935 ..	660,803	277,258	2 7 8
April and May, 1936 ..	649,815	276,881	2 6 11
April and May, 1937 ..	650,040	275,426	2 7 2
*Sept. 1, 1934, to May 31, 1937	10,530,093	4,443,269	2 7 5

* Commencement of subsidy payments.

MARKETING NOTES

Livestock Industry Bill. The Second Reading and Committee stages of this Bill in the House of Lords have now been completed. The Bill has been amended to provide that the "appointed day" for the purposes of Part II of the Bill (subsidy payments) shall be August 1, 1937.

Milk Acts, 1934 and 1936: Manufacturing Milk. Advances made by the Ministry up to June 15, 1937, in respect of manufacturing milk were as follows:—

Section of Act		Period of Manufacture	Quantity	Advances
1	<i>(a) Milk Marketing Board for England and Wales.</i>		Gallons	£
	In respect of milk : Manufactured at factories other than the Board's	April, 1934, to March, 1937.	524,141,426	2,241,910
	Manufactured by the Board.	April, 1934, to Sept., 1935.	2,573,662	12,850
	Made into cheese on farms	April, 1934, to Dec., 1936.	43,658,147	193,078
	Total for England and Wales ..		570,373,235	2,447,838
6	<i>(b) Government of Northern Ireland.</i>			
	In respect of milk : Manufactured into cream and butter at registered creameries.	April, 1934, to March, 1937.	67,365,527	391,231
	TOTAL ..		637,738,762	2,839,069

Owing to the Cheese Milk prices for April, May and June of this year being in excess of the Standard Price, no advances are payable in respect of milk produced and manufactured in these months.

Milk in Schools Scheme. The following figures show the gallonage of milk consumed in the first 6 months of the third year of the scheme compared with the corresponding period in the first and second years. The figures for the third period will be slightly increased when further returns are received.

	Gallons	Exchequer Contribution
October, 1934, to March, 1935 ..	13,104,996	£285,807
October, 1935, to March, 1936 ..	12,045,800	£275,974
October, 1936, to March, 1937 ..	11,860,627	£271,806

MARKETING NOTES

Cheese-Milk Price. For the purpose of payments under the Milk Acts (whether by the Exchequer to Milk Marketing Boards or by Boards to the Exchequer) in respect of milk used for manufacture, the cheese-milk price has been certified by the Minister and the Secretary of State for Scotland to be 6.26 pence per lb. for the month of June, 1937.

Wheat Act, 1932: Sales of Home-grown Wheat, Cereal Year, 1936-37. Certificates lodged with the Wheat Commission by registered growers during the period August 1, 1936, to June 4, 1937, cover sales of 20,589,592 cwt. of millable wheat as compared with 30,964,244 cwt. in the corresponding period (to June 5) in the last cereal year.

Deficiency Payments—Cereal Year 1936-37. The Wheat Commission have decided that no further advance on account of deficiency payments in the current year be made to registered growers.

Regulation of Imports of Bacon and Hams. In the light of a recommendation of the Market Supply Committee, it has been decided that the foreign bacon quota for the first eight weeks of the third quarter shall be fixed provisionally at the rate operative in the first six months of the year. The allocations to the individual foreign exporting countries for the period July 1 to August 25 are as follows:

<i>Country</i>					<i>Allocations Cwt. (a)</i>
Denmark .. .. .	..	..	..	..	516,280
Netherlands .. .. .	..	..	..	..	77,240
Poland .. .. .	..	..	..	..	64,640
Sweden .. .. .	..	..	..	..	38,216
Lithuania .. .. .	..	..	..	..	23,984
Estonia .. .. .	..	..	..	..	6,096
Finland .. .. .	..	..	..	..	3,252
Latvia .. .. .	..	..	..	..	5,692
U.S.S.R. .. .. .	..	..	..	..	6,912
Argentina .. .. .	..	..	..	..	5,692
U.S.A. .. .. .	..	..	..	..	65,043
Allowance for imports from foreign countries not scheduled to the Bacon (Import Regulation) Order					19,670
TOTAL					832,717

(a) Subject to any adjustments necessitated by overshipments or undershipments in previous periods.

MARKETING NOTES

Imports of Mutton and Lamb, 1937: Agreement in principle has been reached with New Zealand and Australia concerning the arrangements for the regulation of imports of mutton and lamb from the Dominions in 1937.

New Zealand and Australia will receive the same basic allocations as for 1936, i.e., 3,900,000 cwt. and 1,750,000 cwt. respectively. As regards Australia, however, the year October 1, 1936, to September 30, 1937, has been adopted as the period of allocation in lieu of the calendar year 1937 in order to fit in with the Australian shipping season. The basic allocations may be increased if the United Kingdom Government are of the opinion that additional quantities can be accepted without endangering the stability of the market; on the other hand it was arranged that they might be reduced by not more than 3½ per cent. if, in the first six months of 1937, prices of United Kingdom mutton and lamb fell appreciably below the average of 1935-1936 prices.

In view of the improved price position, it has been agreed that New Zealand and Australia should be entitled to ship 110,000 cwt. and 50,000 cwt., respectively, additional to their basic allocations. A further review of the market position is now taking place.

As provided for in the Ottawa Agreements and the recent Trade Agreement with Argentina, imports of mutton and lamb from foreign countries are being regulated on the same basis as in 1936, when they were limited to approximately 65 per cent. of the quantities sent in the Ottawa Standard Year (July, 1931-June, 1932).

National Mark Scheme for Plums. The Minister has given notice of intention to make revised regulations, under the Agricultural Produce (Grading and Marking) Acts, 1928 and 1931, prescribing grade designations, grade designation marks and standards of quality for plums. The amendments relate to the amount of dispersed russet permitted in the various grades, to a reduction in the existing size specifications for the variety "Belle de Louvain," and to the inclusion of all varieties of greengages.

Copies of the draft regulations may be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller, price 2d. each (2½d. post free).

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National Mark Canned Fruit and Vegetables. At a recent meeting the National Mark Canned Fruit and Vegetables Trade Committee recommended the inclusion in the Scheme of certain varieties of broad beans, mainly those with pale green hilums. Draft Regulations prescribing a grade designation, "Select Fresh Broad Beans," and definitions of quality, will shortly be published.

The Committee further recommended the inclusion in the "List of approved varieties of vegetables," of the varieties of peas known as "Dwarf Canner" and "Onward." Effect will be given to this recommendation.

A recommendation was also made that all sizes of cans approved for the packing of other fruits should be approved for the packing of apples. (The range of cans includes sizes A. 10, A. 2½, A. 2, E. 1 and Picnic.) The recommendation is being adopted.

National Mark Fruit Products Scheme. The National Mark Cider, Perry and Fruit Products Trade Committee considered the question of extending the scope of the National Mark Scheme for Fruit Products which has hitherto been confined to two grades of fruit juice syrups. In view of the progress which has been made in the technique of production of other fruit products, the Committee recommended the extension of the scheme to include fruit juice, fruit concentrates and aerated fruit beverages. The proposed grade designations for these products are "Select Fruit Juice," "Select Fruit Concentrate" and "Select Aerated Fruit Beverage."

These grade designations, together with definitions of quality, will be included in draft regulations proposed to be made under the Agricultural Produce (Grading and Marking) Acts. As with fruit juice syrups, the definitions of quality will specify certain requirements as to flavour, colour, specific gravity, alcohol content and the use of sweetening materials and preservatives.

The same conditions as regards the minimum output qualification of applicants for enrolment in the scheme will apply as for fruit juice syrups, viz., makers and bottlers not enrolled in any of the National Mark schemes relating to cider, perry, canned and bottled fruit and vegetables and jam will normally be required to have an annual output of fruit products of all kinds of not less than 3,000 gallons.

MARKETING NOTES

Marketing Demonstrations. Particulars of exhibits and demonstrations to be staged by the Ministry during July are as follows:—

<i>Show</i>	<i>Demonstration</i>
Royal, Wolverhampton .. July 6-10.	.. Egg testing, fruit grading and livestock demonstrations. Fruit, dairy produce, egg and honey exhibits.
Great Yorkshire, York .. July 13-15.	.. Egg testing and grading, and livestock demonstrations. Dairy produce, egg and honey exhibits.
Kent, Canterbury .. July 14-16.	.. Plum grading demonstration. Fruit, table poultry, honey and vegetable exhibits.
Royal Welsh, Monmouth July 21-23.	.. Egg - testing demonstration. Dairy produce, egg and honey exhibits.
Royal Lancs, Manchester July 29-Aug. 2.	.. Egg testing and grading, and livestock demonstrations. Dairy produce, egg and fruit exhibits.

Union of South Africa: Agricultural Marketing Act, 1937. The Agricultural Marketing Bill referred to in the April, 1937, issue of the *Journal* (p. 67) has been enacted, subject to certain amendments and additions made in committee. The most important of these excludes the need for the approval of a marketing scheme by Parliament, it being held that consumers are sufficiently protected by the provision for an *ad hoc* committee of investigation should cause for complaint arise. Existing boards of control are now entitled to submit schemes to the Minister for approval, but other schemes must have the approval of three-fifths of the producers, representing more than half the total production of the product proposed to be regulated. A consumer's committee may propose to the Minister the amendment of any scheme. The Governor-General may suspend any provision of the Dairy Industry Control Act which is inconsistent with a scheme relating to dairy products, and a regulatory board is now empowered to impose a variable levy on a sliding (quantitative) scale on different classes or qualities of a product.

JULY ON THE FARM

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In normal years in southern and earlier districts, July sees the end of hay-making and the commencement of harvest, while in the north and later districts July sees the peak of hay-making activities and August is the harvest month.

At the time of writing, it looks as if good hay crops will be won in most areas if there is favourable weather.

A sufficient supply of well-won hay will be a great asset to many farmers, as purchased feeding stuffs are high in price and there seems to be little prospect of any great reduction in the immediate future. Where sufficient really good quality hay is available the feeder is certainly less dependent on purchased concentrates.

The tendency to reduce labour and to depend more on machinery for hay-making makes it most important that all machines should be in good repair, and risks of breakdown reduced to a minimum. Good hay-making certainly depends very much upon weather conditions, but skill in handling the crop in the correct manner is of very great importance.

The root crop has been sown under variable conditions and although the weather in the early part of June was favourable for germination there were many complaints of trouble from the Turnip Flea beetle. Where potatoes were planted under good conditions they have come through quickly and are making rapid growth. Little opportunity was afforded for cleaning land before putting in green crops, and it is therefore desirable that no opportunity should be missed for drill cultivation and cleaning. The root crop usually allows for an opportunity to reduce weeds, but in many districts the opportunity is still to come this year.

Lime and Phosphates. The proposed Government aid in relation to the use of lime and basic slag will no doubt encourage many farmers to more liberal use of these fertilizers. Many of our soils are very deficient in the constituents supplied by these manures. On certain soils lime is lost at a rapid rate, while for many generations phosphates have too commonly been sold off the farm in milk, in the bones of live-stock and in crops, without any recompense. The result is that on large areas of land the need for one or other, or both, of these fertili-

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zers definitely limits crop production. It is important, therefore, to try to ensure that an economic return will be obtained from money expended on such manures.

At Cockle Park, excellent results have been obtained from the use of lime on arable land. Greatly increased crops and reduction in losses from finger-and-toe and other diseases have followed its application. It is nevertheless true that on much of the grass land that lies on the Boulder Clay, and is only moderately acid in character, no economic return has resulted from the application of lime. The Cockle Park results hold good for considerable areas of Boulder Clay land in Northumberland and possibly for other parts of the country. On some of the lighter soils in the North of England lime has given very good returns on grass land, and in the West Riding of Yorkshire the results from lime have often been most striking.

Experience of the use of lime suggests the desirability of arriving at some measure of the need for lime by having samples of the soil analysed, and, if the need is not abnormally high, to dress a small area only in order to make sure that an adequate return may be expected before embarking on great expenditure. County Agricultural Staffs have a good knowledge of the likely response of soils in different areas to applications of lime, and may be able to arrange a chemical test if required. While it is true that, in a general way, lime is greatly needed, there are particular instances even with indications of acidity, where no economic return may be obtained.

As far as phosphates are concerned, it should be borne in mind that different types of phosphatic manures give varying results according to conditions. In the drier districts of East Anglia, insoluble ground mineral phosphates are not largely used, superphosphates being usually preferred. The soluble phosphate of the latter gives good results under dry climatic conditions. In the North of England on poor pastures of low productivity, especially those of a rather wet, acid type, ground mineral phosphates frequently give good results, especially in the first stages of improvement. For later dressings, after the productivity of the pastures has been considerably increased, and with a greater demand for available phosphates, good quality high citric soluble basic slag usually gives better returns. On light soils it is often necessary to apply potash in addition to phosphates, and always it is wise to make sure potash is not a limiting factor to improvement.

Basic slag of high citric solubility costs more per unit of

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phosphoric acid than the low soluble types. For dry soils and land of high productivity the high citric soluble slags usually give the best results and justify the extra expenditure.

While manuring may provide the basis for pasture improvement, correct management of the grazing is equally important. Greater production of pasturage needs increased stock : without this, waste and deterioration of the pasture will follow.

Grazing Stock. On pastures grazed mainly by sheep and with only few cattle, the flowering stems of the grasses are now seen in abundance. The disadvantage of allowing pasture plants to produce seed, on account of waste, loss of vitality and productiveness, has already been referred to in these articles. Where pastures tend to run to seed, topping by the mowing machine does much to prevent harmful effects.

On early feeding land, many cattle will already have been sold. If such pastures are to maintain a high output it is of first importance that they should be kept properly grazed. Good graziers are at great pains to ensure efficient grazing management of the best feeding pastures. Sometimes efficient grazing of the poor pastures on the farm may be sacrificed for these good feeding fields.

During recent years, it has often been said of some of the best graziers that they would rather waste money than waste grass. The poor return for beef frequently meant that the full stocking of the pasture led to increased loss, but these pastures have been maintained in first-class condition ready to give increased returns as the market for beef improves. What may have appeared to be waste will have, in many instances, proved to be a profitable investment.

In many districts there has been an abundance of pasture. During the first week in June after a good spell of growing weather there were many complaints of a falling off in yield of dairy cows in the North of England. An opportunity was taken of inspecting the pasturage of several farms and it was found that the more abundant the pasture, especially if there was much stem growth, the greater was the fall in yield. This emphasizes the need for control, not only of the amount of grass consumed by the cow, but also the type of the herbage.

Every effort should be made to prevent a falling away in milk yield, as the loss is very difficult to recover, and the efficiency of the individual cow is reduced for the remainder of the lactation. July is frequently a month when pastures

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deteriorate and some compensation in the way of concentrates should be given to the cows on most farms. Judicious management and feeding can do much to reduce the fall off in yield that is usually experienced in dairy herds during July, August and September.

Sheep. During the month ewes for drafting and casting will be drawn. With hill and running flocks, the draft ewes go out according to ages, but with breeding flocks on lower ground ewes may be retained as long as they are serviceable. With some flockmasters as with other breeders of farm livestock, there is a definite prejudice against age and frequently first-class breeding stock are disposed of when they could be usefully retained for a longer period and are replaced by (unproved) youngsters. The desirable qualities in a breeding ewe such as type, economic conversion of food, mothering or milking qualities, constitution prolificacy and prepotency are difficult to combine in an individual. When these are found developed to a high degree in any individual every effort should be made to propagate this type of animal. In sheep-breeding, greater attention to individual selection on the female side would no doubt result in an improvement in many of our flocks. It is done in some of our successful breeding flocks but there appears to be need for an extension of the practice.

Whatever the inherent possibilities may be with an animal, management in the end plays an important part in determining just how far these possibilities are developed. With the increased demand for lamb and the selling off of sheep at light weights, more lambs are needed. Hence prolificacy is a factor that is sought after as evidenced by the popularity and higher prices obtained for prolific breeds or crosses. There is no doubt that, on certain types of farms, much advantage is obtained from "flushing" the ewes before mating. Sheep should be kept in improving condition at mating time. "Flushing" also helps in that the ewes come to the ram at about the same time, with the result that the lambing period is shortened, management is easier, and a more uniform lot of lambs can be marketed.

Bovine Mastitis. This trouble is responsible for serious losses in dairy herds. The term mastitis covers a number of distinct pathological conditions of the mammary gland caused by a number of different species of organism. Thus, what is commonly called a "weed" is a chronic form of mastitis due

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to infection with micro-organisms called streptococci, while an acute form of mastitis prevalent in summer months and known as "udder clap" or "garget" is brought about by a micro-organism of an entirely different species.

The chronic form of mastitis occurs among dairy cows throughout the year and especially in older cattle, produces udder damage, and ultimately leads to hardening of the quarter and reduced yield. Edwards estimates that about 30 per cent. of dairy cows are affected with this disease.

The channel of infection is now thought to be almost exclusively by way of the teat canal and infection of the udder is facilitated by wounds or abrasions of the gland. It is interesting to note that the disease does not arise spontaneously once all known sources of infection have been removed. Recent researches have proved the disease to be contagious (i.e., spread by contact) and transmission is frequently by way of the milker's hand.

Efficient control of contagious mastitis demands the segregation of infected cows, or where this is not possible the chance of spread is limited by milking them last. Some success has recently been claimed by treating infected udders with infusions of chemical substances, and those interested in this new treatment are advised to consult their veterinarians.

With regard to the acute or summer form of mastitis, this principally affects dry in-calf cows and heifers that are at grass during July and August. This form is characterized by marked systemic disturbance and the affected quarter is swollen, hard and painful. The course of this disease is frequently rapid and may result in death. Care should be taken in drying off cows at this season and frequent inspection is advisable when animals are at grass. In certain localities dairy cattle would appear to be more prone to this form of mastitis, which may be carried by flies.

Finally it must be emphasized that cleanliness in all dairy operations is the sheet anchor for the prevention of mastitis, as indeed of other troubles, and dairymen should do all in their power to increase the efficiency of herd hygiene. If a single case occurs it should be viewed with grave concern and prompt measures should be adopted.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended June 9th				
	Bristol	Hull	L'pool	London	Costs per Unit¶
Nitrate of Soda (N. 15½%) ..	£ s. 7 12c	£ s. 7 12c	£ s. 7 12c	£ s. 7 12c	s d. 9 10
" " Granulated (N. 16%) ..	7 12c	7 12c	7 12c	7 12c	9 6
Nitrate of Lime (N. 13%) ..	7 0c	7 0c	7 0c	7 0c	10 9
Nitro-Chalk (N. 15½%) ..	7 5c	7 5c	7 5c	7 5c	9 4
Sulphate of Ammonia :—					
Neutral (N. 20·6%) ..	7 5c	7 5c	7 5c	7 5c	7 0
Calcium Cyanamide (N. 20·6%)	7 5d	7 5d	7 5d	7 5d	7 0
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 0	4 17	4 15	4 17	3 3
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%)	8 3	8 1	7 17	8 1	3 3
Sulphate " (Pot. 48%)	9 15	9 13	9 9	9 13	4 0
Basic Slag (P.A. 15½%) ..	2 12b	2 5b	—	2 10b	3 2
" " (P.A. 14%) ..	2 8b	2 0b	2 0b	2 6b	3 3
Grd. Rock Phosphate (P.A. 26-27½%) ..	2 12a	—	2 10a	2 5a	1 8
Superphosphate (S.P.A. 16%) ..	3 4	—	3 3e	3 0f	3 9
" " (S.P.A. 13½%) ..	3 1	2 17	2 19e	2 16f	4 1
Bone Meal (N. 3½%, P.A. 20½%)	—	6 10	7 5g	7 0	—
Steamed Bone Flour (N. ½%, P.A. 27½-29½%) ..	5 5h	5 10	5 0g	5 0	—

Abbreviations : N. = Nitrogen ; P.A. = Phosphoric Acid ;
S.P.A. = Soluble Phosphoric Acid ; Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery, f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater ; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 4-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 4 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra, for lots of 10 cwt. and under 1 ton, 15s. extra, and for lots of less than 10 cwt. but not less than 2 cwt., 20s. extra.

e Prices shown are f.o.r. Widnes.

f Prices shown are f.o.r. northern rails ; southern rails 1s. 3d. extra.

g Prices shown are f.o.r. Appley Bridge.

h Price shown is f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent. nitrogen contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Research at Shinfield. In commemoration of the twenty-fifth anniversary of the establishment of the National Institute for Research in Dairying, the staff of the Institute have issued a special volume, in which is given, along with an outline of the history of the Institute, a condensed summary of the research results achieved in the many lines of activity covered by its work. These are set out in twelve chapters, of which those dealing with Dairy Herd Management, Pig Feeding, Milk Taints, and Nutritional Value of Milk have special interest for us in these notes, and may be briefly reviewed.

Calf Rearing. On the farm side much attention has been given to rearing problems. After several years' work involving tests of free choice feeding and the rearing of groups of calves on different quantities of milk and on different mixture of concentrates, a satisfactory method of rearing calves with a minimum use of whole milk was evolved, in which not more than 30-40 gallons of milk, spread over the first eight weeks, are required. This amount can be reduced to 15-20 gallons per calf, if dried milk is also utilized.

Moderately heavy winter feeding of young dairy heifers brought them to suitable breeding size about five months earlier than when on light feeding, but no advantage was shown in the subsequent milk yields.

For yearling heifers, grazing during the daytime, a daily allowance of 16 lb. of good hay gave fair results, which became quite satisfactory when the hay was supplemented by $\frac{1}{2}$ lb. of concentrates containing 20-30 per cent. of protein. If a proportion of straw was included in the rations it was found of advantage to give a small supplement of ground chalk.

Protein Requirements. Special interest attaches to the large-scale co-operative experiment on the protein requirements of dairy cows, at present in progress under the direction of the Institute. This experiment was started in 1935-6 with eighteen herds, including some 500 cows, and in the present year data are being obtained from twenty-eight herds, with some 900 cows. Protein supplies are mostly expensive, and in large measure

NOTES ON FEEDING

derived from imported materials, so that precise information on protein requirements is of great importance to the economy both of the farm and of the nation, and the results of this co-operative effort cannot fail to be of great value.

In recent years, work at the Hannah Dairy Research Institute on the influence of the "quality" of the protein supply on milk secretion, has indicated that the amount of the amino-acid *lysine* in the make-up of the protein may have an appreciable influence upon the amount of milk secreted. Practical feeding tests at this Scottish institute demonstrated that some rations that contained proteins poor in lysine gave less milk than when proteins rich in lysine were included. These results were not confirmed, however, in an experiment carried out at Shinfield last year, when the effect of adding a high protein food rich in lysine to a ration of low protein content was compared with the effect of adding another high protein food poor in lysine to the same ration. A more extended study of this important problem is clearly desirable.

Pig Feeding. The experimental work of the Institute with pigs has been chiefly concerned with studies of the nutritive value of milk and vitamin requirements. The general growth-promoting properties of even small quantities of milk—no more than one-half pint per head daily—have been strikingly demonstrated. As the quantity of milk was increased a still further improvement was effected, but not proportionate to the increase of supply. The most economic return from a given quantity of milk is thus obtained by spreading it over as many young pigs as possible.

The vitamin research of the Institute has demonstrated the practical importance of vitamins A, B and D in pig-feeding. In recent years attention has been largely concentrated upon vitamin A, and it has been shown that some of the rations commonly used in pig-feeding practice may be deficient in this vitamin.

In studies of anaemia in suckling pigs confirmation has been obtained of the now generally accepted view that this disorder is due to deficiency of iron in the sow's milk, and may be checked by administration of iron direct to the suckers before the critical third and fourth weeks of life. Dosing the piglets with solutions of iron salts, smearing the sow's teats with the iron solutions, and providing cinders treated with ferrous sulphate in the "creep" were all found to be effective.

NOTES ON FEEDING

Milk Taints. The work on milk taints arising from the food has included studies of the effect of chamomile, marrow-stem kale and molassed sugar-beet pulp. The weeds known collectively as chamomile, when present in quantity in hay, were found to impart an unpleasant tar-like flavour to the milk. The taint was more pronounced in early than in later winter, presumably owing to volatilisation of the tainting ingredient from the hay during storage.

The sickly, kale-like flavour sometimes found in milk from cows receiving marrow-stem kale was found to be dependent upon the quantity fed, the limit of safety varying as between individual cows. In a few instances not more than 20 lb. per day could be fed without producing the taint, although the risk was greatly reduced by giving the kale immediately after milking.

With molassed beet pulp it was proved that the primary cause of taint was the fishy smelling trimethylamine oxide, which arises from the breakdown of the nitrogenous ingredient, betaine, that occurs in sugar-beet and passes into the molasses. From this work further studies have developed on the development of fishy taints in meat fats.

Vitamins in Milk. The Institute was founded in the year in which the first publication was made of the discovery of the vitamins in milk, and much of its work on the nutritional value of milk has been concerned with vitamin problems. An early achievement in this field was the demonstration of the superior vitamin potency of summer (grass-fed) milk over winter (stall-fed) milk. This was followed by the demonstration of the possibility of raising the vitamin A and vitamin D potency of butter by adding codliver oil to the ration; this being accompanied, however, by the less desirable effect of a slight reduction in the percentage of fat in the milk. In other experiments the vitamin D content of milk has been raised by feeding yeast that had been exposed to ultra-violet radiation, and also by feeding cacao shell.

Elaborate tests carried out later with the Institute dairy herd have confirmed the earlier findings that the fat-soluble vitamins of milk (vitamin A, carotene, and vitamin D) are subject to marked seasonal variations, and are present in larger quantities in summer than in winter milk. The amounts of vitamin A and carotene are largely dependent upon the supply of grass, but a high level can be maintained into late autumn if kale or

NOTES ON FEEDING

other greenstuff be supplied as the pasture deteriorates. On the other hand, fresh grass was found to be of little value as a source of vitamin D for the milk, this vitamin being mainly produced by the direct action of the sun's radiation on the cow's skin. In contrast to vitamins A and D the proportions of the other vitamins in milk were found to be relatively constant throughout the year, and to be independent of changes in the cow's diet.

The concentration of vitamin A and carotene is much higher in colostrum than in later milk, and probably the same holds good with vitamin D, especially in summer.

Raw v. Pasteurized Milk. The acute controversy that has long prevailed as to the relative nutritive merits of raw and heated milk made it inevitable that this problem should figure prominently in the research programme of the National Institute. The work has included studies of the effects of sterilization and of the less drastic heat treatment involved in pasteurization.

In early feeding experiments with rats, on a diet of milk and white flour, life could be sustained when raw or pasteurized milk was used, but not with sterilized milk.

In later experiments with rats, in which raw milk was compared with milk from the same bulk submitted to commercial pasteurization by the holder method, no difference could be detected between the two supplies, either in the digestibility and biological value of the protein, or in the availability of the calcium and phosphorus. When used for rats as an exclusive diet pasteurized milk supplemented with iron, copper and manganese was, pint for pint, not inferior to raw milk supplemented in the same way. The heating apparently did not affect the vitamin A or its precursor, carotene, but caused some loss of B and C vitamins.

Apart from its bearing upon the sale of liquid milk, the question of the possible influence of pasteurization upon the nutritive value of milk is of interest on the farm in its incidence upon the use of milk in pig-feeding, and also in calf-rearing where measures of eradication of tuberculosis from the dairy herd are in progress. Whether conclusions based upon work with rats or other laboratory animals are applicable to farm livestock must clearly remain doubtful until tested out directly with the latter. It is of interest, therefore, to note the results of a calf-rearing experiment, carried out on a scale not hitherto attempted, that are contained in a report issued by the Milk

NOTES ON FEEDING

Production Department of the West of Scotland Agricultural College.

The Scottish trial was conducted with 35 dairy calves, divided into three groups of winter heifers and three of winter bulls in the trial for 150 days, and two groups of spring bulls and two of spring heifers in the trial for 120 days. Four groups received the colostrum of their dams for 5 days, and the others for 10 days before going on to the raw or pasteurized mixed milk of the herd. The milk was pasteurized by heating at 145--150 degrees F. for 30 minutes. The milk was given at the rate of 1 lb. per 10 lb. liveweight until a maximum daily allowance of 15 lb. was reached. After the third week the calves had free access to good hay and received an allowance of concentrates (maize, oats, linseed cake and bran) graduated according to age. Each calf was weighed at birth, and thereafter every ten days. Certain body measurements were also taken at the time of weighing.

All the groups made reasonably good liveweight gains. The winter bull calves on raw milk throughout gave an average gain in liveweight in 150 days of 364 per cent. of their average weight at birth; while those fed on pasteurized milk after 5 days gained 330 per cent. The spring bull calves on raw milk throughout gained 272 per cent. in 120 days, and those on pasteurized milk after 5 days gained 244 per cent. in the same period. There appeared therefore, to be a small advantage in the raw milk feeding.

With heifer calves there was a similar difference only in the earlier weeks. Heifer calves put on pasteurized milk after 10 days on colostrum took two months to catch up with those on raw milk throughout, while those put on pasteurized milk after 5 days took four months to overtake the raw milk heifers. By the end of the first year the heifers on raw milk had made a liveweight gain of 590 per cent., as compared with 554 per cent. for those on pasteurized milk after 10 days old.

Whether the differences recorded would be accepted as "significant" by the statistician is doubtful, but taking them as they stand they suggest a small superiority of raw milk over pasteurized milk, which was greater with bulls than with heifers. It is also recorded that the calves on raw milk had the best coats, whilst those on colostrum for 5 days only and then on pasteurized milk were worst in this respect.

Disease was more frequent among the calves on pasteurized milk than among those on raw milk, the incidence being the

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heavier the shorter the initial period on colostrum. This applied also to the specific incidence of tuberculosis, three out of four calves that reacted being the group of winter heifers put on pasteurized milk after only 5 days on colostrum. A colostrum feeding period of at least 10 days would thus appear to be desirable on the grounds both of growth-rate and health.

Experimental work of this kind suffers from the difficulty of securing and handling a sufficiently large number of comparable animals, and whilst the Scottish trial excels previous trials in this respect, so far as the total number of calves is concerned, the complexity of the scheme reduced the numbers per group to only 3 or 4 calves. The results will therefore hardly be accepted as decisive, but they are certainly suggestive and establish a *prima facie* case for a more extensive test of this important practical issue that arises both in calf-rearing and in pig-feeding.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	9 17	0 8	9 9	72	2 7	1.38	9.6
Barley, British Feeding	8 15	0 8	8 7	71	2 4	1.25	6.2
" Argentine	9 0	0 8	8 12	71	2 5	1.29	6.2
" Danubian	8 5*	0 8	7 17	71	2 3	1.21	6.2
" Persian	8 12	0 8	8 4	71	2 4	1.25	6.2
Oats, English, white ..	9 7	0 9	8 18	60	3 0	1.61	7.6
" " black and " grey	9 3	0 9	8 14	60	2 11	1.56	7.6
" Scotch, white ..	10 0	0 9	9 11	60	3 2	1.70	7.6
" Canadian No. 2 " Western	10 13*	0 9	10 4	60	3 5	1.83	7.6
" " mixed feed	9 7	0 9	8 18	60	3 0	1.61	7.6
Maize, Argentine	7 0	0 7	6 13	78	1 8	0.89	7.6
" Gal. Fox	6 12†	0 7	6 5	78	1 7	0.85	7.6
Beans, English, Winter	7 0§	0 17	6 3	66	1 11	1.03	19.7
Peas, Japanese	22 13†	0 15	21 18	69	6 4	3.39	18.1
Dari	8 15†	0 8	8 7	74	2 3	1.21	7.2
Milling Offals :—							
Bran, British	6 17	0 16	6 1	43	2 10	1.52	9.9
" broad	7 17	0 16	7 1	43	3 3	1.74	10.0
Middlings, fine, im- ported	8 3*	0 13	7 10	69	2 2	1.16	12.1
Weatings†	7 17	0 14	7 3	56	2 7	1.38	10.7
" Superfine†	8 7	0 13	7 14	69	2 3	1.21	12.1
Pollards, imported ..	7 2	0 14	6 8	50	2 7	1.38	11.0
Meal, barley	9 17	0 8	9 9	71	2 8	1.43	6.2
" " grade II	9 2	0 8	8 14	71	2 5	1.29	6.2
" maize	7 7	0 7	7 0	78	1 10	0.98	7.6
" " germ	7 10	0 11	6 19	84	1 8	0.89	10.3
" locust bean	7 15	0 5	7 10	71	2 1	1.12	3.6
" bean	8 12	0 17	7 15	66	2 4	1.25	19.7
" fish (white)	14 15	2 2	12 13	59	4 3	2.28	53.0
" soya bean (extracted)†	9 0	1 9	7 11	64	2 4	1.25	38.3
Maize, cooked, flaked ..	7 15	0 7	7 8	84	1 9	0.94	9.2
Linseed cake—							
English, 12% oil ..	10 2	1 0	9 2	74	2 6	1.34	24.6
" 9%	9 10	1 0	8 10	74	2 4	1.25	24.6
" 8%	9 5	1 0	8 5	74	2 3	1.21	24.6
Cottonseed cake, English, Egyptian seed, 4½% oil	6 2	0 18	5 4	42	2 6	1.34	17.3
Cottonseed cake, Egyptian, 4½% oil ..	5 12	0 18	4 14	42	2 3	1.21	17.3
Cottonseed cake, decorticated, 7% oil ..	8 15†	1 8	7 7	68	2 2	1.16	34.7
Cottonseed meal, decorticated, 7% oil ..	8 5†	1 8	6 17	70	1 11	1.03	36.8
Coconut cake, 6% oil ..	7 5	0 18	6 7	77	1 8	0.89	16.4

PRICES OF FEEDING STUFFS (*continued*)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Ground nut cake, decorticated, 6-7% oil	8 17§	1 8	7 9	73	2 0	1·07	41·3
Ground nut cake, imported decorticated, 6-7% oil	8 0	1 8	6 12	73	1 10	0·98	41·3
Palm-kernel cake, 4½-5½% oil	7 12§	0 11	7 1	73	1 11	1·03	16·9
Palm-kernel cake, meal, 4½% oil	8 2§	0 11	7 11	73	2 1	1·12	16·9
Palm-kernel meal, 1-2% oil	7 10§	0 12	6 18	71	1 11	1·03	16·5
Feeding treacle	5 0	0 8	4 12	51	1 10	0·98	2·7
Brewers' grains, dried ale	5 10	0 11	4 19	48	2 1	1·12	12·5
Brewers' grains, dried porter	5 2	0 11	4 11	48	1 11	1·03	12·5
Dried sugar-beet pulp ..	May delivery—From £5 7s. 6d. to £6 2s. 6d. June delivery—From £5 7s. 6d. to £5 15s. per ton ex factory (according to factory).						

* At Bristol.

§ At Hull.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the beginning of June, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 per ton as shown above, the cost of food value per ton is £10. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1·43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 3d.; P₂ O₅, 2s. 3d.; K₂ O, 3s. 6d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows:—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6·2	8 12
Maize	78	7·6	7 0
Decorticated ground-nut cake	73	41·3	8 8
„ cotton-seed cake	68	34·7	8 15

(Add 10s. per ton, in each instance, for carriage.)

The cost per unit starch equivalent works out 2·16 shillings, and per unit protein equivalent 0·78 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent	Protein equivalent	Food Value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	8 3
Oats	60	7·6	6 16
Barley	71	6·2	7 18
Potatoes	18	0·8	2 0
Swedes	7	0·7	0 16
Mangolds	7	0·4	0 15
Beans	66	19·7	7 18
Good meadow hay	37	4·6	4 4
Good oat straw	20	0·9	2 4
Good clover hay	38	7·0	4 8
Vetch and oat silage	13	1·6	1 9
Barley straw	23	0·7	2 10
Wheat straw	13	0·1	1 8
Bean straw	23	1·7	2 11

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d., post free 7d.

MISCELLANEOUS NOTES

The Agricultural Index Number

The general index number of prices of agricultural produce for May is 133 (base, May, 1911-13=100) or 7 points below the previous month and 18 points above that for May, 1936. If allowance be made for payments under the Wheat Act and the Cattle Industry Act, the revised index is 136. The reduction in the price of liquid milk to the summer level occurred in May whereas in the base period it took place in April and, in consequence, the fall in index is considerable; this reduction is entirely responsible for the decline in the general index.

Monthly index numbers of prices of Agricultural Produce (Corresponding months of 1911-13 = 100)

Month	1932	1933	1934	1935	1936	1937
January	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	140
May	115	102	112	111	115	133
June	111	100	110	111	116	—
July	106	101	114	114	117	—
August	105	105	119	113	119	—
September	104	107	119	120	127	—
October	100	107	114	113	125	—
November	101	109	114	113	125	—
December	103	110	113	114	126	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and the Cattle Industry (Emergency Provisions) Act (b)

Month	1932	1933	1934	1935	1936	1937
January	—	111	119	124	125	133
February	—	110	117	122	123	133
March	—	106	112	118	122	134
April	—	109	116	126	128	143
May	—	105	116	117	120	136
June	—	104	114	117	121	—
July	—	104	117	120	121	—
August	108	108	122	120	124	—
September	108	111	125	128	133	—
October	104	112	121	119	129	—
November	105	113	120	119	129	—
December	107	114	120	120	130	—

(a) Commenced August, 1932. (b) Commenced September, 1934.

MISCELLANEOUS NOTES

In the following table the monthly index numbers of prices of individual commodities are shown for the months of February to May, 1937, and May, 1936, and May, 1935; base, the corresponding months of 1911-13=100.

Commodity	1935	1936	1937			
	May	May	Feb	Mar.	Apr.	May
Wheat	67	84	122	121	131	124
Barley	91	105	124	124	132	133
Oats	97	82	116	115	119	119
Fat cattle	89	94	99	102	106	112
„ sheep	140	130	137	145	153	160
Bacon pigs	104	113	126	122	119	118
Pork „	106	108	125	124	117	116
Eggs	99	109	115	121	112	112
Poultry	125	121	121	123	113	122
Milk	162	162	171	171	215	162
Butter	87	96	97	100	104	106
Cheese	94	103	107	110	109	112
Potatoes	113	174	201	200	191	196
Hay	100	82	98	101	100	100
Wool	83	96	131	130	138	141
Dairy cows	98	101	111	111	112	112
Store cattle	90	96	101	105	109	115
„ sheep	105	107	115	117	128	133
„ pigs	115	118	139	129	126	125

Revised index numbers due to payments under the Wheat Act and the Cattle Industry (Emergency Provisions) Act

Wheat	109	115	134	134	131	125
Fat cattle	102	107	114	117	120	126
General Index	117	120	133	134	143	136

Grain. At an average of 9s. 10d. per cwt., wheat was lower on the month by 1d. per cwt., the index moving downwards by 7 points. Barley at 10s. 2d. and oats at 8s. 10d. per cwt. showed a rise of 1d. and 5d. per cwt. respectively; the index for the former is slightly higher than in April, but that for oats is unaltered owing to a proportionately similar increase having taken place in the base price. In May, 1936, wheat averaged 6s. 9d., barley 8s. 1d. and oats 6s. 1d. per cwt.

Live Stock. During the month under review quotations for fat cattle showed a further advance, the average of second quality at 41s. 6d. per live cwt. being again higher by

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2s. 9d., and the index rises by 6 points to 112. The addition of the subsidy under the Cattle Industry (Emergency Provisions) Act, 1934, brings the index up to 126. Fat sheep, at 1s. per lb. for second quality, were reduced by $\frac{1}{4}$ d. per lb., but, as a fall of $\frac{1}{2}$ d. per lb. was recorded during the corresponding months of 1911-13, the index moves upwards by 7 points. Baconers and porkers at 11s. 8d. and 12s. 2d. per score (20 lb.) declined by 3d. and 2d. per score respectively, and as these reductions were slightly more than in the base period, the index of each is 1 point lower than in April.

All classes of store stock were dearer than a month earlier; indices for store cattle and sheep are 6 and 5 points respectively higher, but those for dairy cows and store pigs are about unchanged.

Dairy and Poultry Produce. As a result of the decline of 4d. per gallon in the regional contract price of liquid milk, the index shows a fall of 53 points to 162. The latter figure is, however, the same as in May, 1936, and May, 1935. At 1s. 0 $\frac{3}{4}$ d. per lb. butter averaged 1d. per lb. less than in April, but as the reduction was smaller than that recorded during the base years, the index moves upwards by 2 points. Eggs averaged 9s. 2d. per 120 compared with 8s. 6d. in the previous month, but the index remains the same. At £4 1s. 6d. per cwt. cheese was slightly lower in price; here again the downward movement which occurred during the base period was greater and, in consequence, the index rises by 3 points.

Other Commodities. Prices of potatoes rose during May by 2s. to £8 15s. 6d. per ton, but in the base months showed a slight reduction, and the index is 5 points higher than in April. Both clover and meadow hay were slightly lower in price, but the combined index figure is not altered. At 1s. 6 $\frac{1}{2}$ d. per lb. quotations for wool were higher by $\frac{3}{8}$ d. per lb. and the index shows a further rise to 141.

The National Diploma in Agriculture and the Fream Memorial Prize

The 38th Annual Examination for the National Diploma in Agriculture was held, under the auspices of the National Agricultural Examination Board, at the University of Leeds from April 14 to 22, 1937, when 208 candidates presented themselves. Of this number, 13 took the whole examination;

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80 who had already passed in certain subjects appeared to take the remaining portion; and the other 115 came up for a first group of subjects. Of this last 115, 53 (including 2 women) passed in a group of subjects and are eligible, therefore, to take the remaining subjects in either 1938 or 1939.

Of the 93 candidates sitting for the Diploma, 48 (including 2 women) were successful, four of them obtaining Honours. These were Mr. H. R. Kirby (Midland Agricultural College), Mr. D. L. Sinclair (Harper Adams Agricultural College), and Messrs. J. Pearce and K. N. Russell, both from Reading University. The training colleges of the successful candidates were as follows:—

	<i>Diploma</i>	<i>First Group of Subjects</i>
<i>England :</i>		
Armstrong College, Newcastle-upon-Tyne ..	2	3
East Anglian Institute of Agriculture	6	—
Harper Adams Agricultural College	7	4
Leeds University	1	2
Midland Agricultural College ..	9	10
Non-collegiate	—	1
Reading University	5	6
Royal Agricultural College, Cirencester	—	3
Seale-Hayne Agricultural College	1	4
School of Agriculture, Cambridge	1	—
South-Eastern Agricultural College		
<i>Wales :</i>		
University College of Wales, Aberystwyth ..	2	2
<i>Scotland :</i>		
Bell Baxter Continuation School, Cupar ..	—	2
Edinburgh University	2	—
Edinburgh and East of Scotland Agricultural College	—	5
Glasgow University	4	3
West of Scotland Agricultural College	3	7
	48	53

The Fream Memorial Prize, awarded to the Candidate obtaining the highest marks in the examination, was secured by Mr. H. R. Kirby, of the Midland Agricultural College. The prize, of an approximate value this year, of £7, provided from a fund entrusted to the Ministry as a memorial to the late Dr. Fream, is applied to the purchase of books selected by the recipient as best calculated to assist him in pursuing his agricultural studies.

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The Maynard Ganga Ram Prize: Third Award

The Managing Body of the above Prize have now made their award for the year 1935. The Prize, of the value of 3,000 rupees, goes to R. S. L. Jai Chand Luthra, I.A.S., Professor of Botany, Punjab Agricultural College, Lyallpur, for his new method of treating wheat-seed to free it from the fungal disease called Loose Smut. The disease is present in most parts of the Punjab and causes considerable loss to cultivators. The old method of treatment, involving the use of a thermometer, required skill and accuracy in raising water to a temperature that, while sufficient to kill the spores of the disease inside the wheat-grain, would yet leave the germinating power of the seed undamaged. Such a method, needless to say, was unsafe in the hands of unskilled and illiterate people. In the treatment devised by Professor Luthra, the use of a thermometer is dispensed with. The wheat-seed to be treated is merely soaked in water at ordinary temperature for four hours during the morning of a day in summer. The soaked grain is then spread in the sunshine until it is thoroughly dried. Experience has shown that this treatment is effective in controlling the disease without damaging the germinating power of the seed; and the process can be carried out safely by any illiterate worker.

The Maynard Ganga Ram Prize owes its inception to the generosity of the late Sir Ganga Ram, C.I.E., M.V.O., who gave a sum of 25,000 rupees to the Punjab Government for its endowment. The Prize is awarded triennially for a discovery, or an invention or a new practical method which will tend to increase agricultural production in the Punjab on a paying basis. The competition is open to all the world, government servants also being eligible to compete.

The first award, in respect of the year 1929, was made to Dr. Barber, late Imperial sugar expert, for discoveries that resulted in the production of Coimbatore sugarcane. The second (1932) award was given to Mr. T. A. Miller Brownlie, late Agricultural Engineer to the Punjab Government, for an improved slip strainer for use in connexion with well-water supplies. By its use, owners of lands irrigated from well-water supplies have been able to increase their output of water and, consequently, their crops.

The Prize is now open for award in respect of 1938, and entries should reach the Director of Agriculture, Punjab, Lahore, on or before December 31, 1938.

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Farm Institute Live Stock Judging Competition

The eleventh annual Live Stock Judging Competition, open to teams of three from Farm Institutes in England and Wales, was held at the farm of Mr. J. H. Rowe, Bridgetown House, Stratford-on-Avon, on Thursday, June 3, 1937. Teams from the following counties competed:—Cumberland and Westmorland (Newton Rigg), Hertfordshire (Oaklands), Monmouthshire (Usk), Northamptonshire (Moulton), Staffordshire (Rodbaston).

The teams were required to judge Dairy Shorthorn Cows, Shire Horses, Large Black and Large White Cross-bred Pigs for bacon purposes, Cross-bred Down Ewe Tegs for the butcher and Buff Rock Poultry. The stock to be judged were typical commercial stock. The classes were not easy and provided a good test.

The team from Monmouthshire were the winners with a score of 281 marks out of a possible 365. The second team, Cumberland and Westmorland, were 15 marks behind.

The following judges officiated:—Dairy Cows—Mr. W. J. Wheeler; Horses—Mr. E. B. Wynn; Sheep—Mr. G. A. Lea; Pigs—Mr. N. D. Clarke; Poultry—Mr. R. G. Virtue.

The teams and officials were afterwards entertained to lunch by the National Farmers' Union Mutual Assurance Society, when Mr. Black, a Director, presented to the winning team the Silver Challenge Cup provided by the National Farmers' Union.

The Committee has expressed its disappointment at the small entry for the Competition this year.

Register of Dairy Cattle

Volume XX of the Register of Dairy Cattle has just been published. It contains particulars of 766 cows in respect of which Certificates of Merit have been issued by the Ministry since October 1, 1936, as compared with 722 cows entered in the previous volume. To be eligible for a Certificate of Merit, a cow must have given, during a period of three consecutive Milk Recording Years, not less than the prescribed yield of milk and must normally have calved three times during those years. The prescribed yields for the three-year period are 30,000 lb. for Friesians; 27,000 lb. for Ayrshires, Blue Albions, Lincoln Red Shorthorns, Red Polls and Shorthorns; 24,000 lb. for all other breeds except Dexters; and 21,000 lb. for Dexters.

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The Register contains a statement showing the number and distribution of the yields of the cows of the various breeds entered, and the highest yield certified for each breed for the three years ended October 1, 1936. Of these cows 15 gave over 50,000 lb. of milk during the three years concerned; 47 over 40,000 and under 50,000 lb.; 91 over 35,000 and under 40,000 lb.; 238 over 30,000 and under 35,000 lb.; 227 over 27,000 and under 30,000 lb.; and 115 over 24,000 and under 27,000 lb.

Particulars of pedigree bulls of proved milking strain are also given. The condition of entry of a bull in the Register is that its dam and sire's dam have given the standard yield prescribed for their breed or type in any particular Milk Recording Year. The volume contains entries relating to 16 bulls.

A list of the Milk Recording Societies in England and Wales, with particulars of each Society and the name and address of its Secretary, is included in the Register.

Dairy farmers and others desirous of acquiring high-yielding milk-recorded cows that have been regular breeders should find the Register a valuable book of reference.

The Register can be obtained through any bookseller or from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, price 1s., post free 1s. 3d. A copy of the volume is issued free to all members of Milk Recording Societies.

The Work of Agricultural Research Institutes

The annual volume of reports on the work of the Agricultural Research Institutes in Great Britain and Northern Ireland has become well-known to the readers of this *Journal*, and this note is intended to draw attention to the appearance of the latest volume.* In addition to the reports of the Research Institutes, the volume contains reports of the research work undertaken by Agricultural Advisory Officers, and special investigations financed by the Departments of Agriculture and the Agricultural Research Council. Naturally enough, it is not possible in this publication to give anything more than a brief summary of the work done but this summary is presented in non-technical language, so that it shall be readily understood by the layman. It is difficult to

* Report on the Work of Agricultural Research Institutes, 1934-35. London: H.M. Stationery Office, 1937. 5s. post free.

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select examples, but amongst the wide range of activities it describes may be mentioned a number of soil surveys of different parts of the country, a large number of references to the cultivation of grass-land, and the allied problems, a subject which is very much to the forefront at the present time.

In addition to the combined reports contained in this volume, it forms a useful reference work for those who wish to pursue inquiries into the originally published work, because it contains a list of the publications of the workers concerned.

The Carnegie Trust

The activities of the Carnegie United Kingdom Trust continue to include several of an agricultural type, the most remarkable being grants in aid of land settlement schemes. The twenty-third annual report of the Trust just issued* records that to the end of last year specific grants for this purpose amounted to £35,000 in addition to an annual grant of £1,500 for five years towards the administrative expenses of the Land Settlement Association. The Trustees have intimated their willingness to consider during 1937 applications for grants in respect of new settlements up to a maximum of £40,000. During the year twenty-six grants totalling £3,310 were made in respect of village halls. For the quinquennium 1936-40 an allocation of £2,400 has been made to Young Farmers' Clubs, which now number 250. During the past six years the Trustees have taken a keen interest in the preservation of rural amenities, and over £14,000 has been devoted to this object.

Vegetable Oils and Oilseeds

THIS survey, issued by the Imperial Economic Committee,† follows the same general lines as the Committee's commodity studies of meat, fruit, etc. The seeds, etc., to which most attention is given are those used for the production of the leading oilcakes, such as cotton seed, linseed, ground-nut

* The Twenty-third Report of the Carnegie United Kingdom Trust. Obtainable from the Secretary, Carnegie United Kingdom Trust, Comely Park House, Dunfermline, Fife.

† *Vegetable Oils and Oilseeds : A Summary of Figures of Production and Trade relating to Cottonseed, Linseed, Rapeseed, Sesame Seed, Soya Beans, Ground Nuts, Copra, Palm Kernels, Palm Oil and Olive Oil.* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. Price 2s. 6d., post free 2s. 9d.

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and palm kernel cakes, but statistics are also provided for the minor seeds and for margarine, compound lard, etc. As far as is possible with the limited data available, the survey gives figures for world production, world trade, utilization and prices, with emphasis particularly on the supplies and requirements of the Empire. A short preface is provided on the "Nature and Utilization of Vegetable Oils." This branch of the trade in animal feeding stuffs has previously been so ill documented that all concerned will be grateful to the Imperial Economic Committee for the additional information they have provided, particularly at the present time when the price levels of feeding stuffs are a matter of concern.

Fifth Selected Bibliography of Literature on Mechanization of Agriculture.

The Ministry has issued a further selected bibliography on "Mechanization of Agriculture," containing references to books and periodicals filed in the Ministry's library. Although the bibliography cannot be said to be a complete list of publications dealing with the mechanization of agriculture, it includes references to mechanization in most branches of the industry and contains the titles noted from certain publications issued during the year January to December, 1936. A few titles of articles which appeared in January, 1937, are also included as it has not been found practicable to confine such a list precisely to the limits of time mentioned.

Amongst the many subjects included may be mentioned the numerous entries relating to tractors and tractor equipment. The articles on crop drying will be of particular interest at the present time.

The bibliography has been widely circulated in Great Britain and a few copies are available, free of charge, to any agricultural worker or person interested.

The N.I.A.B. Farm Crop Variety Trials.—The National Institute of Agricultural Botany again invites farmers and others interested to visit the accurate field trials of cereals, root crops, etc., carried out by the Institute at Cambridge and at its Sub-stations at Askham Bryan (Yorks), Cannington (Somerset), Long Sutton (Hants), Newport (Salop), and Sprowston (Norfolk). Profitable varieties of the crops may be seen growing, and their relative merits discussed with members of the staff. July is the best month for visits, either to Cambridge or, if more convenient, to the nearest of the Sub-stations mentioned above. Parties or single visitors are welcome, but arrangements should be made beforehand by writing to the Secretary, N.I.A.B., Huntingdon Road, Cambridge.

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Farm Workers' Minimum Rates of Wages.—Meetings of the Agricultural Wages Board were held at Kings Buildings, Smith Square, London, S.W.1, on May 24, 1937, and June 21, 1937.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders :—

Derbyshire.—An Order cancelling the existing minimum and overtime rates of wages (other than the overtime rates for the hay and corn harvests of 1937, which remain in force), and fixing fresh rates in substitution therefor to come into operation on June 26, 1937, and to continue in force until December 25, 1937. The minimum rate for male workers of 21 years of age and over is 8½d. per hour (instead of 8d. as formerly). For whole-time workers provision is made for payment of not less than 37s. 1½d. (instead of 36s. as formerly) per week of 54 hours, except in the week in which Christmas Day falls when the hours are 45. The overtime rates for adult male workers remain unchanged at 10d. per hour on Sundays and 9d. per hour for employment on Christmas Day. The minimum rates for female workers of 18 years of age and over are unchanged at 5d. per hour, with overtime (i.e., employment on Sundays) at 8d. per hour.

Dorset.—An Order fixing the minimum and overtime rates of wages to come into operation on July 1, 1937 (i.e., the day following that on which the existing rates are due to expire), and to continue in force until June 30, 1938. The minimum rates are (i) in the case of male workers of 21 years of age and over 33s. (instead of 31s. as formerly) per week of 51 hours in summer except in the weeks in which Good Friday, Easter Monday, Whit Monday and August Bank Holiday fall when the hours are 42, and 48 hours in winter, except in the weeks in which Christmas Day and December 27, 1937, fall when the hours are 39½; (ii) in the case of female workers of 21 years of age and over (other than part-time and casual workers) 24s. (as formerly) per week of 48 hours, except in the weeks in which Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and December 27, 1937, fall when the hours are 39½, with, in addition, in the case of all workers referred to above, not more than 3 hours on the holidays mentioned on work in connexion with milking and the care of and attendance upon stock; and (iii) in the case of part-time or casual female workers of 18 years of age and over, 5d. per hour. The overtime rates are 8d. per hour for male workers of 21 years of age and over (except for overtime employment in the hay and corn harvests when the rate is 9d. per hour) and 6d. per hour for all classes of female workers of 20 years of age and over (as formerly).

Hampshire and Isle of Wight.—An Order cancelling the existing overtime and minimum rates of wages and fixing fresh rates in substitution therefor to come into force on June 6, 1937, and to continue in operation until January 1, 1938. The minimum rates for male workers of 21 years of age and over are 32s. (instead of 31s. as formerly) per week of 51 hours in summer, except in the week in which August Bank Holiday falls when the hours are 41½, and 48 hours in winter, except in the weeks in which Christmas Day and Boxing Day fall when the hours are 40. The overtime rates are unchanged at 9d. per hour throughout the year, except in the case of carters, cowmen, shepherds or milkers for work in connexion with the immediate care of animals in which case the overtime rate is 8d. per hour. The minimum rate for female workers of 18 years of age and over remains unchanged at 5d. per hour for all time worked.

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Lancashire.—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor to come into operation on June 27, 1937, and to continue in force until April 30, 1938. The minimum rates in the case of male workers of 21 years of age and over are: In the Southern Area, workers employed wholly or mainly in one or more of the following capacities—Stockman, Teamsman, Poultryman, Pigman or Shepherd (instead of for workers employed wholly or mainly with animals as formerly) 38s. per week of 52½ hours, and other workers 34s. 6d. per week of 50 hours (as formerly), and in the remainder of the area of the Committee, workers of the special classes mentioned above (instead of for workers employed wholly or mainly with animals as formerly) 41s., and other workers 38s. 6d. per week of 60 hours (as formerly) in each case. The overtime rates for all classes of adult male workers remain unchanged at 9d. per hour on weekdays and 1s. 1½d. per hour for employment (other than time necessarily spent in the immediate care of and attention to animals) on Sundays. Overtime at 9d. per hour is also payable for employment (other than immediate care of and attention to animals) on Christmas Day and Good Friday. In the case of female workers of 18 years of age and over, the minimum rate remains unchanged at 6d. per hour for all time worked.

Lincs. (Holland).—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor to come into force on June 27, 1937, and to continue in operation until October 30, 1937. The minimum rates in the case of male workers of 21 years of age and over are 36s. (instead of 35s. as formerly) per week of (i) 41 hours in the week in which August Bank Holiday falls, and (ii) 50 hours in any other week. In the case of horsemen, cattlemen and shepherds of similar age additional weekly sums are fixed to cover all time worked in excess of the number of hours mentioned above, except employment which is to be treated as overtime employment. The overtime rates in the case of male workers of 21 years of age and over are 1s. 1½d. per hour on Sundays, 9d. per hour on August Bank Holiday and 10½d. per hour for all other overtime employment (as formerly). The minimum rate for female workers of 15 years of age and over is unchanged at 6d. per hour, with overtime at 7d. per hour for all employment in excess of 5½ hours on Saturday or other agreed weekly short day, on Sundays and in excess of 8 hours on any other day (as formerly).

Lincs. (Kesteven and Lindsey).—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor to come into force on June 27, 1937, and to continue in operation until January 29, 1938.

The minimum rates in the case of male workers of 21 years of age and over are: (i) waggoners, 40s. (instead of 39s. as formerly) per week of 50 hours in the week in which August Bank Holiday falls, 58 hours in any other week up to October 14, 52½ hours in the week in which Christmas Day falls and 61 hours in any other week subsequent to October 14; (ii) shepherds, 38s. (instead of 37s. as formerly) per week of 45½ hours in the week in which August Bank Holiday falls, 55 hours in any other week in summer, 47½ hours in the week in which Christmas Day falls and 56 hours in any other week in winter with additional payments for the lambing season; (iii) stockmen, 39s. (instead of 38s. as formerly) per week of 46½ hours in the week in which August Bank Holiday falls, 56 hours in any other week in summer, 49½ hours in the week in which Christmas Day falls and 58 hours in any other week in winter; and (iv) other male workers, 33s. (instead

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of 32s. as at present) per week of 41 hours in the week in which August Bank Holiday falls, 50 hours in any other week in summer, 39½ hours in the week in which Christmas Day falls, and 48 hours in any other week in winter, with overtime in the case of all classes of male workers at 10d. per hour on weekdays and 1s. on Sundays (as formerly). Provision is made for an adjustment of the hours in respect of which the minimum weekly wage is payable in the week in which Boxing Day falls to meet cases where a holiday is given in that week instead of in the week in which Christmas Day falls. In the case of female workers of 17 years of age and over the minimum rate is unchanged at 5½d. per hour for all time worked.

Shropshire.—An Order fixing minimum and overtime rates of wages to come into force on June 1, 1937 (i.e., the day following that on which the existing rates are due to expire). The minimum rates for male workers of 21 years of age and over are 34s. (instead of 32s. 6d. as formerly) per week of 54 hours, except in the weeks in which Christmas Day and Good Friday fall when the hours are 44½, with overtime unchanged at 9d. per hour on weekdays and for attention to stock on Sundays, and 10d. per hour for other employment on Sundays. The minimum rates for female workers of 18 years of age and over remain unchanged at 5d. per hour and overtime at 6d. per hour.

Staffordshire.—An Order varying the existing minimum and overtime rates of wages, the rates as varied to come into force on June 27, 1937.

The minimum rates in the case of male workers of 21 years of age and over are 34s. (instead of 32s. 6d. as formerly) per week of (a) 44½ hours in the weeks in which Christmas Day and Good Friday fall; and (b) 54 hours in any other week, with overtime unchanged at 9d. per hour. The minimum rates in the case of female workers of 18 years of age and over remain unchanged at 5d. per hour with overtime at 6d. per hour.

Sussex.—An Order fixing minimum and overtime rates of wages to come into force on July 12, 1937 (i.e., the day following that on which the existing rates are due to expire), and to continue in operation until April 10, 1938. The minimum rates in the case of male workers of 21 years of age and over are: (i) for workers employed wholly or mainly as horsemen, cowmen, stockmen or shepherds, 38s. 3d. (instead of 37s. 6d. as at present) per week of (a) 50 hours in the week in which Christmas Day falls, and (b) 58 hours in any other week; and (ii) for other workers, 33s. 3d. (instead of 32s. 6d. as at present) per week of (a) 52 hours in any week in summer; (b) (i) 40 hours in the week in which Christmas Day falls, and (ii) 48 hours in any other week in winter. The overtime rates in the case of all classes of adult male workers are unchanged at 9d. per hour on weekdays, and 10½d. per hour on Sundays.

The minimum rate of wages for female workers of 18 years of age and over is 5d. per hour, with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays as at present.

Yorks (West Riding).—An Order varying the existing minimum and overtime rates of wages, the rates as varied to come into force on June 27, 1937.

The minimum rates in the case of male workers are (a) for all workers of 21 years of age and over, other than specified in paragraph (b) below, 35s. 6d. (instead of 34s.) per week of 52½ hours in summer and 48 hours in winter, except (i) in the weeks in which Easter Monday, Whit Monday, and August Bank Holiday fall, when the hours are 43, and (ii) in the week in which Boxing Day falls, when the hours are 39½; and (b) for workers of 21 years of age and over employed as waggoners or other horsemen, beastmen or shepherds, 40s. 6d. (instead of 39s.) per week

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of the hours specified in (a) above, with, in addition, not more than 12 hours per week on weekdays and 3 hours on Sundays and when holidays on full pay are given, 3 hours on those holidays, for work in connexion with the care of and attention to stock. Provision is made for an adjustment of the hours in respect of which the minimum weekly rates are payable to meet cases where 1, 2, 3 or 4 days' holiday on full pay are given in particular weeks in lieu of Easter Monday, Whit Monday, August Bank Holiday and Boxing Day. The minimum rate for female workers of 18 years of age and over is 6½d. (instead of 6d.) per hour for a week of 44 hours. The overtime rates are (i) male workers of 21 years of age and over (a) waggoners or other horsemen, beastmen or shepherds, 9d. (as at present) per hour on weekdays and 11d. (instead of 10½d.) per hour on Sundays; (b) other male workers, 10½d. (instead of 10d.) per hour on weekdays and 1s. 0½d. (instead of 1s.) per hour on Sundays; and (ii) female workers of 18 years of age and over 8d. (instead of 7½d.) per hour on weekdays and 9½d. (instead of 9d.) per hour on Sundays.

Anglesey and Caernarvon.—An Order fixing special overtime rates of wages for male workers employed in harvest work during the hay and corn harvests of 1937 and minimum and overtime rates of wages for male workers engaged specially for such work. The minimum rates for male workers of 21 years of age and over are (1) for all male workers a differential overtime rate of 10d. per hour, and (2) for workers engaged specially for harvest work, (i) employed by the week or any longer period, 44s. 6d. per week of 58 hours, and (ii) employed by the day (a) on weekdays other than Saturday, 8s. 8d. per day of 10½ hours, and (b) on Saturdays, 5s. per day of 6 hours.

Denbigh and Flint.—An Order fixing minimum and overtime rates of wages for male workers employed on harvest work during the hay and corn harvests of 1937. The rates for male workers of 21 years of age and over are (i) for workers (other than casual workers), a differential rate for overtime employment of 1s. per hour, and (ii) for casual workers, a minimum rate of 1s. per hour for all hours worked on harvest work.

Enforcement of Minimum Rates of Wages.—During the month ending June 11, 1937, legal proceedings were taken against five employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow:—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers involved
Gloucester	Stroud ..	£ s. d. 10 0 0	£ s. d. 0 12 6	£ s. d. 36 13 7	1
Lancashire	Ashton-under-Lyne ..	10 0 0	—	50 0 0	1
"	Reedley ..	1 10 0	0 4 0	14 15 2	2
Glamorgan	Neath ..	*	3 0 6	6 0 0	1
Pembroke	Newport ..	1 0 0	0 12 0	10 13 6	1
		22 10 0	4 9 0	118 2 3	6

* Dismissed under " Probation of Offenders " Act.

Foot- and- Mouth Disease.—Outbreaks of Foot-and-Mouth Disease were confirmed on June 6 at Woodbury, Exeter, Devon, and on June 9 at Westfield, Woking, Surrey. The usual restrictions were imposed over areas of approximately 15 miles radius round the respective premises.

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The areas under restrictions lie in the county of Devon, and in the counties of Berks, Buckingham, Hants, Middlesex and Surrey, respectively. The outbreak at Woodbury was the first in Great Britain for four months, the last outbreak previously having been confirmed at Donnington, Hereford, on February 5.

No further outbreak has been confirmed in either of the Infected Areas, and the Devonshire Area was contracted to approximately 5 miles around Woodbury on June 21 and the Surrey Area to 5 miles around Westfield on June 24.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND.

Cheshire: Mr. F. H. Foster, B.Sc., N.D.A., has been appointed Assistant Lecturer in Agriculture and Farm Book-keeping, *vice* Mr. N. A. Selkirk, B.Sc. (Agric.), N.D.A.

Cumberland and Westmorland: Mr. L. E. Edney, B.Sc. (Agric.), has been appointed Assistant Agricultural Organizer and Vice-Principal of the Farm Institute, *vice* Mr. A. Mann, B.Sc.

Devon: Miss V. C. Milner, N.D.P., has been appointed Assistant County Poultry Instructress, Miss E. E. M. Cheal, N.D.P., has been appointed Instructress to the Travelling Poultry School.

Surrey: Mr. J. E. Campion, M.A., has been appointed Assistant Agricultural Organizer, *vice* Mr. R. Line, B.Sc.

WIRELESS TALKS, JULY, 1937

AGRICULTURAL

<i>Station and Date</i>	<i>Time : p m</i>	<i>Speakers</i>	<i>Subject</i>
National :	—	No talks in July	—
Midland : July 7	6 20	Various	Discussion at the Royal Agricultural Show, Wrothesley Park, Wolverhampton. Viewpoints and personalities.
West : July 8	8 40	Various	For Western Farmers in particular : The Agricultural and Horticultural Research Station, Long Ashton.
North : July 19	6 20	Mr J A Willis, a Yorkshire Farmer	Drystone Walling (one of a series, "Tricks of the Trade").
Welsh : July 16	7.30	Professor R. G. Stapledon, Professor J. A. Scott Watson, Dr. F. T. Wahlen, Dr. P. D. Cardon and Dr. E. Bruce Levy	What is Grassland ? (in connection with the Fourth International Grassland Conference).
Scottish : July 1	8 0	Mr. J. F. Duncan	For Scottish Farmers.
" 8	6 30	Mr. A. Allan interviewed by Mr J. R. Allan	Moorland Pasture.
" 15	6.20	Mr. W. J. Wright	For Scottish Farmers.
" 22	6.30	Mr. J. Anderson	Heather Honey.

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HORTICULTURAL

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speakers</i>	<i>Subject</i>
National :			
July 9	7.15	Mr. P. W. D. Izzard	—
" 16	7.15	Mr. H. S. Redgrove	—
" 23	7.15	Mr. H. H. Thomas	—
" 30	7.15	Miss Eleanor Sinclair Rohde	—
West :			
July 7	9.5	Mr. D. Harris	Eye-witness account of the National Sweet Pea Show at Bath.
" 20	9.40	Mr. D. Harris	For Western Gardeners.
North :			
July 2	8.40	Messrs. W. E. Shewell-Cooper and Arthur Behrend	Flower Shows.
" 10	6.50	Mr. W. E. Shewell-Cooper	Eye-witness account of the Alderley Edge (Cheshire) Flower Show.
" 16	6.45	Messrs. W. E. Shewell-Cooper and Oliver Mee	Roses.
" 21	10 25	—	Eye-witness account of the Leeds Flower Show
" 30	6.40	Messrs. D. E. Horton and W. E. Shewell-Cooper.	Bulb-growing for the Amateur.
Scottish :			
July 21	6.15	Mr. Alexander Keith	July in the Garden.

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Proceedings of the IVth International Conference of Agricultural Economists, 1936. Ed. J. P. Maxton. Pp. xiv + 528. Illus. (London : Oxford University Press. 1937. Price 17s. 6d.)

This volume records the papers and speeches delivered at the Fourth International Conference of Agricultural Economists held at St. Andrews during the first week of September, 1936, and provides a most interesting and informative collection of studies on a variety of subjects. Mainly as a result of the policy followed in drafting the programme for the St. Andrews Conference and used consistently by Mr. Maxton in editing these proceedings, it is, however, more homogeneous in its subject-matter than the proceedings of the previous three conferences. There are only seven papers that are what might be called "independent" papers, and most of these are mainly interesting for their informative character. Special mention, however, should be made of Professor von Dietze's paper which raises important issues in the relation of planning or cartelization to the peasant system of production.

The remainder of the volume is divided into eight subjects, which form the topic of more or less extended discussion from various angles. Four of these are fairly specialized. The first is a series of papers and a short discussion on "The Provision of Agricultural Credit," to which Dr. F. F. Hill, Deputy Governor of the U.S.A. Farm Credit Administration, contributed the first paper; the second, "Commercial Policy and the Outlook for International Trade in Agricultural Products," the discussion of which was opened by Mr. A. Cairns, Secretary of the Wheat Advisory

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Committee, on the outlook for the regulation of world wheat supplies; the third, "Problems of Milk Marketing Regulation," opened by Mr. W. H. Bronson, Statistician of the New England Milk Producers' Association and J. Ll. Davies of the Milk Marketing Board; and fourth, "Part-time Holdings for Urban Workers," opened by H. Krause, Berlin, and K. Hood, of Pennsylvania.

The larger part of the volume is occupied by the papers and discussions on the four subjects set down in the programme as the main subjects for discussion at the Conference. These are:—

- (i) The Relations of Agriculture to Industry and the Community, introduced by a paper from Professor W. R. Scott, of Glasgow University.
- (ii) The Relations of Land Tenure to the Economic and Social Development of Agriculture, introduced by papers from Professor M. Sering, Berlin, and Professor A. W. Ashby, University College, Aberystwyth.
- (iii) Farm Organization with Special Reference to the Needs of Technical Industrial and Economic Development of Agriculture, introduced by papers from Mr. L. Bridges, Oxford University, Professor H. Zorner of Berlin, and Mr. H. R. Tolley, Administrator of the A.A.A., Washington.
- (iv) Problems of Consumption of Agricultural Products, introduced by papers from Professor E. R. Cathcart, Glasgow, and Professor R. B. Forrester, Aberystwyth.

The importance of the four main subjects mentioned above needs no emphasis, since they involve fundamental principles in the future planning of agriculture. There is, in fact, a main thread running through all four—namely, the issue of the responsibility of agriculture for its place in the economic and social structure of the community and the responsibility of the community to agriculture. The first main subject took that as the general theme, but its importance is also evident in the discussion of Land Tenure, Farm Organization, and the Problems of Consumption of Agricultural Products. It is evident, although not brought out so clearly, in the papers and discussions on the first two subjects, that there is a fundamental conflict of opinion on what should be the structure of agriculture and its place in the economic and social structure of the State. In the discussion of Farm Organization, however, this conflict of "philosophies" makes itself felt. The contrast is apparent in the different treatments of the opening papers and particularly between the excellent papers of Bridges and Zorner. In the discussion, especially in the contribution by Ashby and the reply by Zorner, this fundamental difference comes quite clearly to a head. Throughout the whole discussion there is an apparent opposition from the British and the Continental point of view, the former emphasizing the industrial and economic attitude towards agriculture and the social considerations which are implicit in it, the latter emphasizing the stabilizing and racial arguments for a large secured peasant population. The American speakers claim that the peasant (in their country the family farmer) is at one and the same time the most economic form of farm organization and the source of the social attributes which the Continental economists claim for it. In this connexion the paper by Professor Boss, of Minnesota, with the short discussion on it, though included as one of the "independent" papers at the end of the volume, is in some ways a most interesting continuation of the discussion on the subject of farm organization and should, therefore, be read along with the main discussion.

Under the section dealing with the Problems of Consumption of Agricultural Products, Professor Cathcart and Dr. Stiebeling, Washington,

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provide valuable information on consumption habits, while Professor Forrester and Dr. von Bulow (I.L.O.) and Dr. Bennett (Food Research Institute, California) deal with the economic implications of consumption on agriculture.

This book is certainly the kind of publication that everyone interested in the economic, political and social aspects of national and international agriculture should read. The programme of the conference, and in particular the editing of the papers and discussions by Mr. Maxton and his colleagues at Oxford, make it easy to select the papers and discussions in which the reader is most interested.

Report on the Marketing of Wheat in India. Pp. ix + 451, 4 maps, 24 diagrams, 35 plates, 54 appendices. (Delhi: Government of India. Price Rs. 1.4 or 2s.)

This is the first of a series of reports on the marketing of agricultural produce in India, which are being prepared by the Agricultural Marketing Adviser to the Government of India and the Central Marketing staff. The series is similar in scope and purpose to the familiar series of Orange Books in this country.

The report is mainly of interest to students of Indian conditions, but it offers much useful information to agricultural economists generally and is a welcome addition to our knowledge of agricultural marketing. It covers all aspects of marketing, including supply, demand, prices, processing, transport, storage, standardization and methods of distribution.

In the chapter on supply, the official statistics of production come in for a certain amount of criticism. The position of India in relation to the world market is well brought out and the dependence of wheat exports on the world price of wheat and on the relative prices of wheat and gram and barley is shown in an interesting diagram on page 41.

Perhaps the diversity of conditions in India is shown vividly in the statistics of consumption per head in Appendix XIV. Consumption varies from under 4lb. per head in Madras to over 25lb. in Delhi.

The effect of weather conditions on marketing is brought out in detail; for example, the effect of the monsoon on the periodicity of sales, and detailed recommendations for overcoming the difficulties are included.

The lack of standardization in the wheat trade is emphasized throughout the report. It is mentioned in nearly all the chapters. The trade descriptions of similar types of wheat vary greatly from district to district and even in neighbouring localities. The amount of "refraction" allowed both in ready and in future sales varies just as much. Published prices are, therefore, valueless for the purpose of trading in distant markets. The confusion in weights and measures seems almost incredible and is a serious handicap to organized trading.

The description of prevailing market charges, which range from "charity" deductions to bribes to municipal servants and include in some cases payments to cooks and sweepers, shows the nature of the burdens borne by large numbers of small producers and the need for some measure of control on the lines of the local market legislation already adopted in some parts of India.

The many detailed recommendations in the report are hardly of interest to English readers and they raise no theoretical questions. They do, however, reveal, in a striking manner, how wide are the opportunities for marketing reform in relation to the wheat, crop which represents more than one-tenth of the total cultivated area of the Indian Empire.

The report is well written, but for the English reader a glossary of Indian terms is needed, as he will find it impossible to remember all the terms or to understand them if they are not explained. Even more

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pleasing than the style, however, is the sound commonsense shown throughout the report, and the insistence that the trade should put its own house in order and not rely too much on Government assistance. The printing and the diagrams are clear and good, but some of the photographs might have been better. Altogether, the report is a well-planned and thorough piece of work.

The Mushroom Handbook. By Louis C. C. Krieger. Pp. xiv + 550 and 157 Figs. (London: Macmillan & Co., Ltd., 1936. Price 15s.)

This attractive little handbook is written for American readers, and consequently contains descriptions of some species that do not occur in this country. Apart from this, however, the work can be recommended as a most useful introduction to the study of the larger fungi. The general arrangement of the book follows more or less traditional lines. There is an introductory portion dealing with the ecology, life-histories, economic importance, and classification of the larger fungi, together with some information as to the more common edible and poisonous species and a brief account of methods of mushroom-growing. An unusual feature in a popular work, but a very encouraging one, is the inclusion of an index to the chief literature necessary for the identification of the higher fungi, with references to the bibliography at the end of the book. With notes as to the collection and preservation of herbarium specimens and the characters required in writing descriptions, the general portion of the work occupies 232 pages. The remainder consists of detailed descriptions of species, illustrated by uncoloured photographs and excellent coloured plates, with a very full glossary of technical terms. The book is well produced and of a convenient size. It is evidently intended for use in the field since each copy contains a small cardboard scale of inches divided into twelfths ("lines") for use in measuring fungi.

The Second Conference on Mechanized Farming. A summary of the papers read at the Second Conference on Mechanized Farming appeared in this *Journal* for February of this year. The discussions which followed the papers have now been printed in a companion volume to the papers themselves and copies of the two brochures can be obtained from the Conference Secretary, 10, Parks Road, Oxford, price 2s. 6d., post paid.

ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Hanley, J. A., Boyd, A. L., and Williamson, W.—An Agricultural Survey of the Northern Province. The Counties of Durham, Cumberland, Northumberland, Westmorland. (123 pp. and map.) Newcastle-upon-Tyne: Department of Agriculture, Armstrong College, 1936

Schultze, J. H.—Deutsche Siedlung, Raumordnung und Siedlungswesen im Reich und in den Kolonien. (viii + 158 pp.) Stuttgart: Ferdinand Enke, 1937, RM.6.20. (German Settlements. Organization of Settlements and of Disposition of Lands in the Reich and in the Colonies.)

Kellar, H. A. (Edit.).—Indiana Historical Collections, Vol. XXII. Solon Robinson, Pioneer and Agriculturist, II. 1846–1851. (xvii + 556 pp. + 12 plates.) Indianapolis: Indiana Historical Bureau, 1936.

Second International Congress for Microbiology, London, 1936.—Report of Proceedings. (xiii + 579 pp.) London: Dr. R. St. John-Brooks, Lister Institute, Chelsea Bridge Road, 1937, 20s.

The Land Utilization Survey of Britain. Part 53: Rutland, Margaret E. Broughton. (38 pp.) 1937, 2s. Part 1: Ayrshire,

ADDITIONS TO THE LIBRARY

- J. H. G. Lebon.* (83 pp.). 1937, 2s. 6d. Part 2: Moray and Nairn, *F. H. W. Green.* (pp. 87-124.) 1937, 2s. London School of Economics.
- Tate, W. E.*—The Thoroton Society Record Series, Vol. V. Parliamentary Land Enclosures in the County of Nottingham during the 18th and 19th Centuries (1743-1868). (xxv + 215 pp.) Nottingham, 1935.
- Wilkinson, S. G. G.*—The Tithe Act, 1936. (xx + 171 pp.) London: The Estates Gazette, 1937, 10s. 6d.
- Leigh, Margaret.*—Harvest of the Moor. (291 pp.) London: G. Bell and Sons, 1937, 8s. 6d.
- Golding, E. W.*—The Electrification of Agriculture and Rural Districts (xii + 244 pp.) London: English Universities Press, 1937, 16s.
- Digges, J. G.*—The Practical Bee Guide. (viii + 305 pp.) 8th Edition. Dublin and Cork: The Talbot Press; London: Simpkin, Marshall, 1936, 4s. 6d.
- Ransome, Hilda M.*—The Sacred Bee in Ancient Times and Folk Lore. (308 pp. + 12 plates.) London: Allen & Unwin, 1937, 12s. 6d.
- Kershaw, S.*—Wool, From the Raw Material to the Finished Product. 5th Edition. (xi + 123 pp.) London: Pitman, 1937, 3s.

Agricultural Economics

- Fourth International Conference of Agricultural Economists.*—Proceedings of the Fourth Conference held at St. Andrews, Scotland, Aug. 30-Sept. 6, 1936. (vii + 528 pp. + 2 plates) London: Oxford University Press, Humphrey Milford, 1937, 17s. 6d.
- Clark, C.*—National Income and Outlay. (xix + 304 pp.) London: Macmillan & Co., 1937, 12s. 6d.
- Saller, A.*—World Trade and Its Future. (101 pp.) Philadelphia: University of Pennsylvania Press; London: Humphrey Milford, 1936, 7s. 6d.
- Simpson, E. N.*—The Ejido, Mexico's Way Out. (xxi + 849 pp. + 12 plates.) Chapel Hill: The University of North Carolina Press, 1937, 22s. 6d. London: Humphrey Milford.
- Beilby, O. J.*—Egg Prices—A Study of the Factors affecting Prices and Production. (66 pp.) Oxford: Agricultural Economics Research Institute, 1937, 2s. 6d.
- Lucas, A. F.*—Industrial Reconstruction and the Control of Competition. The British Experiments. (x + 384 pp.) London: Longmans, Green & Co., 1937, 15s.

Botany and Plant Physiology

- James, W. O.*—An Introduction to Plant Physiology. (viii + 265 pp. + 1 plate.) 3rd Edition. Oxford: The Clarendon Press, 1936, 7s. 6d.

Crops

- Armstrong, S. F.*—British Grasses and Their Employment in Agriculture. (xi + 350 pp.) 3rd Edition. Cambridge: The University Press, 1937, 15s.
- Dixey, R. N., and Ashew, R. P.*—Grass-Drying—A Study of Production Costs in 1936. (45 pp.) Oxford: Agricultural Economics Research Institute, 1937, 1s.
- Gardner, H. W.*—The Grassland of Hertfordshire and Its Improvement. An Account of the Experiments conducted by the Hertfordshire Institute of Agriculture, 1923-35. (51 pp.) St. Albans, 1936.

ADDITIONS TO THE LIBRARY

Dairying and Milk Products

- Eberlein, L.*—Die Neueren Milchindustrien. (135 pp.) Dreden, Leipzig: Verlag von Theodor Steinkopff, 1937, R.M.5.50.
Wilts County Council.—Agricultural Education Sub-Committee Advisory Report on Milk Production. (110 pp.) Trowbridge: Polebarn House, 1937.

Diseases of Animals and Veterinary Science

- Imperial Bureau of Agricultural Parasitology.*—The Effects of Some Natural Factors on the Second Ecdysis of Nematode Infective Larvæ, *G. Lapage*. (Reprinted from University of Cambridge Institute of Animal Pathology, Fourth Report, 1934-35.) St. Albans, 1937, 4s.

Fertilizers and Soils

- Russell, E. J.*—Soil Conditions and Plant Growth. (viii + 655 pp. + 11 plates.) 7th Edition. London: Longmans, Green & Co., 1937, 21s.
Hall, A. D.—The Feeding of Crops and Stock. Part 1: The Plant. (ix + 120 pp.) Part 2: Soils and Fertilizers. (ix + 122 pp.) London: Murray, 1937, 3s. 6d. each part.

Food, Nutrition and Preservation

- City and County of Newcastle-upon-Tyne.*—A Study of the Diets of Sixty-nine Working-class Families in Newcastle-upon-Tyne. (45 pp.) Newcastle-upon-Tyne: The City Health Department, 1937, 1s.
Ministry of Health.—Advisory Committee on Nutrition. First Report. (52 pp.) London: H.M. Stationery Office, 1937, 1s.
Board of Trade.—Report of the Food Council to the President of the Board of Trade for the Year 1936. (26 pp.) London: H.M. Stationery Office, 1937, 6d.
Sherman, H. C.—Chemistry of Food and Nutrition. (x + 640 pp.) 5th Edition. New York and London: Macmillan & Co., 1937, 12s. 6d.
Jones, O., and Jones, T. W.—Canning Practice and Control. (xii + 254 pp. + 63 plates.) London: Chapman & Hall, 1937, 25s.

Fruit Culture and Horticulture

- Auchter, E. G., and Knapp, H. B.*—Orchard and Small Fruit Culture. (xxi + 627 pp.) New York: John Wiley & Sons; London: Chapman & Hall, 1937, 25s.
Hoare, A. H.—Vegetable Crops for Market. (198 pp. + 19 plates.) London: Crosby Lockwood & Son, 1937, 7s. 6d.
Cobb, A. J. (Editor).—Modern Garden Craft by many expert contributors. Vol. I. (x + 205 pp. + 5 plates.) Vol. II. (vii + 226 pp. + 9 plates.) Vol. III. (vii + 229 pp. + 2 plates.) London: Gresham Publishing Co., 1936, 45s.

Plant Diseases and Pests

- Ainsworth, G. C.*—The Plant Diseases of Great Britain—A Bibliography. (xii + 273 pp.) London: Chapman & Hall, 1937, 15s.
Massee, A. M.—The Pests of Fruits and Hops. (292 pp. + 27 plates.) London: Crosby Lockwood, 1937, 15s.

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NOTES FOR THE MONTH

Gas-storage of Eggs

The following note has been communicated by Dr. T. Moran, Principal Scientific Officer, Low Temperature Research Station (Cambridge), Department of Scientific and Industrial Research:—

In this country the bulk of the eggs that are cold-stored for long periods—5 to 9 months—are held at a temperature of approximately 31° to 33°F. and a relative humidity in the range 80 to 85 per cent. When brought out of store, they differ from new-laid eggs in several respects, the chief being (1) the larger air-cell, (2) the general weakening or liquefaction of the white, creating a tendency for the yolk to sink or stick to the shell, (3) the more pronounced yellow colour in the white, (4) the weakening of the membrane surrounding the yolk, (5) the tendency for the yolk to lose its firm, erect condition and to "spread," (6) the presence in the yolk of a slight but unpleasant taste—the so-called "storage-taste." Further, if the relative humidity of the air in the store rises much above 85 per cent., mould grows on the shell and ultimately penetrates into the egg. All of these changes are aggravated the longer the eggs are held before storage and the higher the temperature during this period.

For some time past experiments that have been carried out at the Low Temperature Research Station in Cambridge have had as their aim a clearer understanding of the structure and chemistry of the different parts of the egg and the conditions of storage that will reduce the changes outlined above to a minimum. The condition of the white, for example, is particularly important. In the fresh egg there are three distinct fractions, an outer thin or liquid layer, a central thick or jelly layer, which encloses the inner thin layer surrounding the yolk. The quality of the white is judged by the firmness of the thick or jelly fraction, and the total amount of thick and

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inner thin; in a new-laid egg this is approximately 80 per cent. of the total white.

Particular attention has been given to the storage of eggs in air containing definite and controlled amounts of carbon dioxide. The effect of this gas is two-fold; it increases the acidity (lowers the pH) of the yolk and white, and thereby controls changes in the structure of the egg (Nos. 2, 3, 4 and 5 above). In addition, it inhibits the growth of mould on the egg, and thereby permits of a higher humidity in the store; this in turn means a smaller air-cell at the end of storage (No. 1 above). American workers¹ have also found that the presence of even 1 per cent. of carbon dioxide retards the appearance of "storage-taste" in the yolk.

During the past year a series of storage trials was carried out in collaboration with the Commercial Division of the Ministry of Agriculture, who judged the quality of the eggs before and after storage by the usual candling technique, and with the research staff of Messrs. J. Lyons & Co., Ltd., who tested the eggs for quality when cooked in different ways. Further experiments of this nature are in progress this year.

A paper has been published² summarizing the earlier laboratory work, and also giving the results of the chemical and physical tests made on the eggs in these storage trials. The storage atmospheres investigated were as follows:—

Experiment	Storage Atmosphere						Mean Relative Humidity
1	Air	..	..	..	..	..	85.0
2	Air containing	2.5 per cent. CO ₂	..	..	..	..	82.5
3	"	5.0 "	..	..	..	..	84.0
4	"	10.0 "	..	..	..	..	84.0
5	"	60.0 "	..	..	..	..	Saturated
6	"	75.0 "	..	..	..	..	"
7	"	85.0 "	..	..	+ 15 per cent. N ₂	..	"
8	"	85.0 "	..	..	+	..	"
9	100 per cent CO ₂	..	..	..	..	..	"

The eggs were examined after 22½ and 38 weeks' storage. In Experiment 8 the eggs were first exhausted to remove dissolved gases and finally filled with the gas-mixture. The temperature of storage was 32°F.

The main conclusion from the experiments was that in every instance there was a reduction in the amount of inner thin white, which had passed through the thick layer to increase the outer thin white. This was most marked in the eggs stored in high concentrations of carbon dioxide (Experiments 5 to 9).

¹ Sharp and Stewart: *U.S. Egg and Poultry Mag.*, 1931, 37, 30.

² Moran: *Jour. Soc. Chem. Ind.*, 1937, 61, 96T.

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The work, however, points to two atmospheres as being of importance in the storage of eggs, (1) air containing $2\frac{1}{2}$ per cent. of carbon dioxide approximately, (2) air containing 60-100 per cent. of carbon dioxide.

As compared with storage in ordinary air, storage in air containing $2\frac{1}{2}$ per cent. of carbon dioxide gives a firmer yolk and a more viscous thick white; but the amount of thick and inner thin white is slightly smaller. This concentration of carbon dioxide, however, has little effect on the growth of mould, so that the eggs must be stored at a relative humidity of about 85 per cent.*

After storage in 60 to 100 per cent. carbon dioxide, the thick white is shrunken and the white as a whole is more fluid. The yolk, however, is very firm whilst, owing to the saturated humidity, there is no increase in the size of the air-cell. The shells of these eggs tend to be white and powdery, owing to the formation of calcium bicarbonate.

No differences could be detected in the quality of the eggs after storage in Experiments 5 to 9.

The paper also describes experiments on the use of controlled amounts of ozone (1 and 5 parts per million by volume) in the storage of eggs. This gas removes musty or undesirable odours from the store, but it helps little towards raising the safe limit of relative humidity with eggs stored in air or in $2\frac{1}{2}$ per cent. carbon dioxide.

Silver Leaf Disease

The following note has been communicated by Mr. W. F. Cheal, D.I.C., N.D.A., Horticultural Superintendent, Isle of Ely:—

In the recommendations for the control of Silver Leaf disease of fruit trees primary emphasis is laid on prevention of the formation of fructifications of the fungus on dead wood. It is recommended that all dead wood should be removed from the orchard and burnt, and that the stumps and roots of dead trees should also be grubbed and removed. It is also suggested that tree stumps on the borders of orchards, if they cannot be removed and burnt, should at least be kept covered with

* It is possible to store eggs in $2\frac{1}{2}$ per cent. carbon dioxide and a saturated humidity free from mould for 9 months at 32° F. by introducing a trace of a volatile fungicide into the atmosphere, but the use of such fungicides is prohibited by the Public Health (Preservatives, etc., in Foods) Regulations.

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soil in order to prevent the development of fructifications of the fungus upon them.

In an instance that recently came to notice the stump of an infected tree, which had been cut off at ground level and covered with a mound of soil, gave rise to the fructifications of *Stereum purpureum* on the surface of the mound. The fungus had grown up from the infected wood through the soil, filling small cavities and lining the interior of larger cavities with a dense mat of mycelium, until it reached the surface, where it spread out forming a spore-bearing surface one or two square inches in area. The distance through the soil which the fungus had grown was about $3\frac{1}{2}$ in.

It would appear, therefore, that covering infected stumps with soil, or burying infected wood, may not always suffice to prevent the fructifications of this fungus developing. The only safe procedure is thus to grub and burn infected stumps.

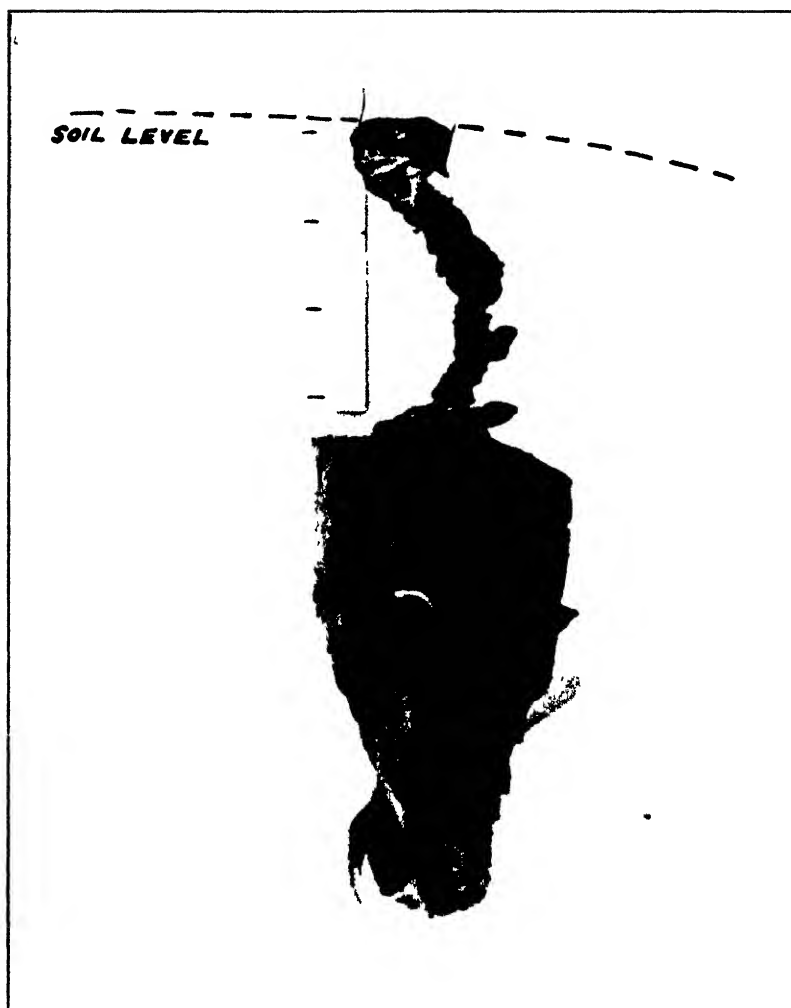
Grey Squirrels

An Order under the Destructive Imported Animals Act, 1932, has been made by the Minister of Agriculture and Fisheries and the Secretary of State for Scotland, acting jointly, known as The Grey Squirrels (Prohibition of Importation and Keeping) Order, 1937, applying the provisions of that Act to the grey squirrel. The Order, which has now been approved by both Houses of Parliament, came into force on July 31.

The effect of the Order is to place the grey squirrel in the same category as the musk rat so far as prohibition of importation and keeping is concerned. As far as is known the animal is not, in fact, imported and kept for profit, but in reaching the decision to make the Order the Minister and the Secretary of State have been guided by the view that "keeping" connotes some deliberate act done by a person for the purpose of, and having the effect of, inducing grey squirrels to remain upon his land, whether in captivity or not, but the omission by a person to take steps to destroy grey squirrels which come upon his land does not by itself constitute "keeping."

The intention of the Order is to facilitate voluntary measures of control of the pest and it is unlikely that the power of entry on land which is conferred by the making of the Order will actually be exercised unless voluntary measures prove inadequate.

• Practical and scientific opinions unite in condemning the grey squirrel as a menace, and an increasing menace. It lives



Photograph W. F. Cheal

Silver Leaf Disease---Fructifications of *Streum purpureum* grown up
from the stump of an infected tree
(An inch scale has been placed beside the fungus)

To face page 420



Robin at nest in old tin can

Photograph Enc J Hosking.

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upon green shoots and buds, nuts and seeds, fruits, the inner bark of young trees, bulbs and roots, birds' eggs and young birds. There are, therefore, few branches of agriculture which do not suffer from its depredations and few parts of the country in which it cannot find the food it requires. Although at the present time it is not found everywhere in Great Britain, it has already colonized a very large area.

It is hoped that all those on whose land it is prevalent will be prepared to co-operate in a campaign to secure the elimination of this pest.

Interesting Birds: (6) The Robin

The Robin is perhaps the best known of all our small birds, and is undoubtedly the most popular. It seems to be aware that it is a general favourite, and is at all times a bold and confiding little bird. It is the subject of a good deal of legend and superstition, a fact that may have something to do with its freedom from molestation. One of the most striking characteristics of the robin is its versatility in the matter of nest building. It seems to be able to adapt its nest to any hole and corner, and uses a variety of receptacles for nesting purposes; old kettles, paint pots, drain pipes, and even discarded boots. It will readily accept artificial nest-boxes. Other interesting facts are that both sexes sing, and are so alike in plumage that they are practically indistinguishable. Both cock and hen have the russet breast and forehead. The young, however, lack this colour in their first year, having a speckled breast rather like that of the thrush, but darker.

The worst that can be said of the robin is that it occasionally takes a little cultivated fruit, but its feeding habits generally can result in nothing but good to the gardener and the fruit grower. It destroys many pests of the orchard and garden—caterpillars and grubs of various kinds as well as winged insects. It also eats worms, slugs, and sometimes wild seeds and berries. It is, therefore, a highly beneficial bird, and should be encouraged and protected. It is fortunate that no sensible person is in the least likely to harm it.

Indoor Farrowing (in Crate) and Outdoor Farrowing in Field Huts: A Comparison

The following note has been communicated by Mr. S. Williams, M.Sc., N.D.A., Midland Agricultural College:—

Last autumn it was decided to farrow a portion of the

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Midland Agricultural College herd of Large White pigs in a farrowing crate indoors and to compare this method with the usual College practice of farrowing in field huts.

For *Indoor Farrowing*, the heaviest and most clumsy and nervous sows were selected during the past winter, being put in the farrowing crate (5 ft. 9 in. \times 2 ft. 3 in.) three or four days before they were due. Exercise was at first intentionally limited to that obtained when the sows were let out half an hour twice each day for feeding. It was soon found that the sows became markedly stiff and often lame when subjected to this treatment, so gentle exercising was practised each day. The sows were generally removed with their litters from the crate into boxes (13 ft. 6 in. \times 11 ft. 6 in.) on the seventh or eighth day after farrowing. When the little pigs reached three weeks old, the sow and litter were moved to field huts, where they remained till weaned. It has now been shown that it is better to move the litters straight from the crate to the field huts about a week after farrowing, the little pigs being fastened in the huts for a day or two.

For *Farrowing in Field Huts* the sows are normally picked out about a fortnight before they are due and placed in separate $\frac{1}{4}$ -acre farrowing runs. A night or two before farrowing, they are fastened in the huts. Artificial heating is provided if necessary and attention is given during farrowing. The sow and young pigs are allowed to go out at will on the second or third day after farrowing, although, in winter, the little ones rarely venture forth until they are two or three weeks old.

During the period, October 17, 1936, to March 24, 1937, 10 sows brought litters in the farrowing crate and 25 farrowed in field huts. A comparison of the results obtained is of interest.

Sows farrowing indoors gave birth to 11.30 live pigs per litter, rearing 7.60 pigs to 6 weeks old. This compares with an average of 11.80 pigs born alive per litter and 8.16 reared to 6 weeks old with sows farrowed in field huts. It is seen that practically the same number of pigs died per litter in each instance, 3.70 in each indoor-farrowed litter and 3.64 in each litter farrowed in field huts. It is found on further examination of our records, however, that the deaths resulted from different causes. With litters farrowed indoors, on the average 2.6 pigs per litter were crushed to death by the sow

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within six days of birth, compared with 3.04 pigs killed in the same way in litters born in field huts. This difference is significant in view of the fact that usually the largest, clumsiest and most nervous sows were selected for crate-farrowing.

As a routine practice, all pigs are dosed with Parrish's Chemical Food when they are three weeks old and before and after if the necessity is obvious. In spite of this treatment, on an average 0.70 pigs died from anaemia in each litter farrowed in the crate, a very high figure compared with 0.06 with litters born in field huts. It is estimated that 60 per cent. of the pigs farrowed in the crate and kept indoors till three weeks old developed symptoms of anaemia, while very few pigs born in field huts showed any signs of this disease. Pigs kept indoors till three weeks old averaged approximately 11.8 lb. and 19.9 lb. liveweight when three and six weeks old, respectively; whilst those raised from birth in field huts weighed 12.6 lb. and 22.8 lb. at these ages. Thus, those farrowed in field huts are the better in respect of liveweight. It is, however, the increase in liveweight from 3 to 6 weeks old that is particularly interesting; 7.1 lb. with the crate-farrowed pigs and 10.2 lb. for the others. It would appear that pigs born and raised in field huts are of higher vitality than those kept indoors to the age of three weeks from birth, and are consequently able to make greater liveweight gains even though the pigs farrowed indoors are kept under identical conditions during their 3-6 weeks-old period.

Deaths from causes other than crushing and anaemia, previously to six weeks old, are slightly more numerous in litters born in field huts (0.54 pigs per litter) than in those farrowed indoors (0.40 pigs per litter).

Referring now to records of the previous year, it is found that 9 of the sows which farrowed in the crate during this past winter had brought litters 12 months previously (i.e., in winter), and it is instructive to compare their performance when they farrowed in the crate with what they did when they farrowed in field huts. Last winter, one of the sows brought her seventh, two their sixth, three their fifth and three their fourth litters. Thus some of them were passing their prime and one would expect a slightly lower standard of performance. When these 9 sows farrowed in field huts, they gave birth to 10.22 pigs per litter, of which 7.22 pigs were reared to six weeks old, when their average liveweight

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was 21.60 lb.—a death rate of 3.00 pigs per litter. When they farrowed indoors, 11.22 pigs were born alive of which 7.33 were reared (average weight at 6 weeks old being 19.81 lb.)—a death-rate of 3.55 pigs per litter. Evidence is thus afforded above confirming the suggestion that outdoor breeding produces heavier pigs at six weeks old than indoor breeding.

In conclusion, it may be stated that the use of the farrowing crate is justified for sows that are likely to be difficult to attend while farrowing, and that there are definite indications that better protection of the young pigs is afforded by its use. It is particularly important, however, that the young pigs should be brought under more or less natural conditions at the end of their first week, otherwise there is considerable risk of anaemia and perhaps other diseases developing. If moved from the crate to field huts at an early age, say seven or eight days old, the young pigs will have been protected against the risk of the sow lying on them and will benefit from being kept in a pure atmosphere, receiving plenty of unfiltered light, and having ready access to green-stuff and soil minerals whenever these are needed.

A Note on the Melancholy Thistle

The following note has been contributed by Messrs. H. Cecil Pawson and Brynmor Thomas of the Armstrong College, Newcastle-upon-Tyne:—

The Melancholy Thistle (*Carduus heterophyllus* L.) probably received its name as the result of a belief in its efficacy as a cure for depression. It is of interest to note that it was one of the personal badges of the House of Stuart. Unlike most members of the genus it is not prickly, although it resembles them in other respects. Its rootstock is perennial and creeping, and it has tall, stout and deeply furrowed stems with some loose cottony wool. The leaves, which clasp the stem, are lanceolate, glabrous and green above, but white and cottony underneath. They are bordered with small, bristly teeth, and are sometimes slightly lobed. The flower-heads are about the size of those of the Spear Thistle (*C. lanceolatus*), and appear in July and August.

According to Bentham and Hooker,* it occurs in mountain pastures in northern Europe and Asia, and is frequent in Scotland, extending into northern England and north Wales. It has been the experience of the writers that, in the north,

* Bentham G. and Hooker, J. D., *British Flora*, 1924, 43, 262.

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the species is not usually found in quantity in pasture or meadow, but more frequently by the side of streams or roads. In one instance, however, they observed this thistle growing in profusion in meadow land on a Northumberland hill farm. The shepherd complained that its presence caused difficulty in winning the hay crop, but affirmed that sheep brought in from the open moor showed a marked partiality for it.

This information stimulated further inquiry, and samples of the thistle were taken for analysis in September, 1935, and November, 1936. The results obtained on these samples are tabulated below:—

<i>Date of Sampling</i>				<i>Sept. 14, 1935</i>	<i>Nov. 3, 1936</i>
				<i>Percentage of</i>	<i>Percentage of</i>
				<i>Dry Matter</i>	<i>Dry Matter</i>
*Crude protein	..	.	..	17.50	12.77
Ether extract	..	.	..	3.11	3.53
N.-free extractives	..	..	..	51.72	54.32
Fibre	..	..	.	14.56	16.83
†Ash	..	..	..	13.11	12.55
*Including :					
True protein	..	.	..	15.39	11.90
†Including :					
Phosphoric acid (P_2O_5)	.	..	..	0.94	0.92
Lime (CaO)	..	..	.	4.61	4.38
Digestibility of crude protein	..	..	..	66.79	50.75

It will be seen that, in the sample of 1935, the crude protein content is comparable with that in good month-old pasture grass. The markedly poorer protein content of the 1936 sample is probably due, in large part, to the later date of sampling. The digestibility of the crude protein, as determined in vitro, is reasonably good, although inferior to that of grass. The two samples show very close agreement in respect of the chief ash constituents, and both show a high mineral content. While the proportion of phosphoric acid present is greater than in many cultivated grasses, the lime content reaches an exceptional level.

Stapledon, in *The Land Now and To-morrow*, lays great emphasis on the value of herbs as mineral supplements, although no species of thistle is included in his list of useful weeds. Special importance is attached to the occurrence of such weeds on poor soils on which the mineral content of grasses and clovers is likely to be low, and the ribgrass and daisy are named as particularly valuable dual-purpose deficiency rectifiers. It is stated that both are grazed by

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stock, and that in certain situations both are frequently hard grazed to the ground in winter. Stapledon's conclusions are supported by the analyses of useful weeds made by Fagan at Aberystwyth. Seven such weeds, known to be consumed by sheep and cattle, contained lime and phosphoric acid ranging from 1.09 to 2.25 per cent., and from 0.86 to 2.01 per cent. respectively. Ribgrass and daisy, which were included in this test, were shown to contain 2.25 and 1.83 per cent., and 1.07 and 0.90 per cent. of lime and phosphoric acid respectively. The species of thistle dealt with in this note is therefore as efficient in respect of phosphoric acid as either ribgrass or daisy, and contains an outstandingly larger amount of lime.

While thistles are generally known to have a high mineral content, they are not much relished by stock, presumably because of their spinous nature. The Melancholy Thistle, which is more leafy and does not suffer from the disadvantage of strong spines, appears to be eaten with avidity, and therefore merits inclusion in any list of valuable mineral-efficient herbs.

LIVESTOCK INDUSTRY ACT, 1937

The Livestock Industry Bill has passed through all stages in Parliament and received the Royal Assent on July 20. The following is a brief summary of the provisions of the Act.*

PART I

Part I provides for the constitution of the Livestock Commission and the Livestock Advisory Committee. The Commission are charged with the functions of keeping generally under review the production, marketing and slaughtering of livestock in the United Kingdom, the preparation for sale of the products of the slaughtering of livestock and the marketing, consumption, treatment and use of such products. It will be their duty to advise and assist Ministers in matters relating to the livestock industry, and to carry out the particular duties assigned to them under the several parts of the Act. [A statement regarding the constitution of the Commission appears on p. 431 of this Journal.]

The Livestock Advisory Committee are to give advice and assistance to the Commission in the discharge of their functions. The Act provides that the Committee shall consist of persons appointed by the Ministers as representing the interests of producers, local authorities, auctioneers and any other interests connected with the livestock industry that are likely to be immediately affected by the operation of the Act. Four additional independent members are to be appointed, and they will act as Chairmen of the main Committee and of sub-committees for England, Scotland and Wales respectively. These sub-committees will have referred to them matters arising only in relation to the particular country they represent.

PART II.

Provision is made in Part II for the continuance of a subsidy to producers of fat cattle in the United Kingdom. The only substantial change is the power taken to give effect to the Government's policy of encouraging further (i) the home breeder, and (ii) the production of good quality beef animals by differential rates of subsidy payment (see full explanation given in the note on p. 432). The Act provides for an aggregate sum not exceeding £5,000,000 to be voted annually by Parliament for subsidy purposes. Provision is made, similar to that contained in the Cattle Industry (Emergency Provisions) Acts, for the marking of imported animals.

* Copies are obtainable from H.M. Stationery Office or through any bookseller, price 1s.

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PART III

Part III empowers the Board of Trade to regulate by order the importation of livestock and meat (except bacon*) if this course appears desirable in order to secure the stability of the United Kingdom market for livestock and meat. The Board of Trade are also empowered to obtain information regarding stocks of meat in the country and imports of livestock and meat.

PART IV

The provisions of this part of the Act are designed to secure an improvement in the system of livestock markets in Great Britain and may be divided into three parts—section 14, which is designed to prevent the creation of unnecessary new markets, sections 15 and 16, under which the livestock markets system can be reorganized by livestock markets orders, and the third part comprising the general regulation of auctions and market premises by means of by-laws (section 17).

The approval of the Livestock Commission must be obtained before new premises are used for the holding of a market—certain exemptions being provided for, more particularly in relation to farm sales. This provision will operate as from November 1 next, the expression "new premises" meaning premises which were not used for holding a market during the year ended November 30, 1936. Under a livestock markets order a particular area may be scheduled in which redundant markets can be closed and the facilities at the remaining authorized markets improved. Provision is made for the payment of compensation. The function of the Livestock Commission in relation to livestock market orders is first to make proposals. The orders are made by Ministers after full enquiry and if necessary after reference to Parliament. The Commission then administers the orders. Livestock markets by-laws will enable the holding and conduct of auctions to be regulated, e.g., in regard to the number of auction places in a particular market, or to the scale of auctioneers' charges. Similarly charges made by market owners in respect of animals brought to the premises can be fixed or limited, and the manage-

* Bacon is excluded from the term "meat" in this connexion because imports are already regulated by order of the Board of Trade, under the Agricultural Marketing Act, 1933, as a complement to the regulation of the marketing of home produce under the Pigs and Bacon Marketing Schemes.

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ment of premises regulated. The days and times at which premises may be used for holding markets may also be determined. By-laws may relate to particular markets or to all markets in a particular area, or relate to particular classes of livestock only. By-laws are made by the Livestock Commission but do not have effect until confirmed by the appropriate Minister.

PART V

This Part of the Act provides for three experiments in central slaughtering with the object of securing data that will be of value when consideration is given in due course to the question of a national slaughtering policy.

The Livestock Commission may consider proposals put before them by any person, local authority or other body for the provision of a slaughterhouse that might serve the purpose of a central slaughterhouse conducted on the meat-works principle, i.e., one in which efficiency and economy in slaughtering would be promoted by treating carcasses and meat in the most satisfactory manner and by utilizing by-products to the best advantage. When satisfied as to the suitability of any such proposal the Commission may submit for the approval of the Minister concerned a scheme providing for the control of slaughtering activities in the area round the proposed central slaughterhouse in order to ensure an economic throughput for that undertaking. Such a scheme may make provision, *inter alia*, for closing slaughterhouses in the area or for controlling the throughput of other slaughterhouses in the area. Compensation may be paid under the scheme to the owners of closed slaughterhouses, or persons owning slaughtering businesses who suffer loss or damage, such compensation being payable by the person or authority carrying on the central slaughterhouse.

Provision is made to enable a local authority to establish and carry on a central slaughterhouse for the purpose of the Act; and certain of the administrative functions of the Commission under this Part of the Act may be delegated to a local authority carrying on a central slaughterhouse.

Exchequer grants or loans may be made towards the cost of providing central slaughterhouses. Such advances are limited to £250,000, of which not more than £150,000 may be advanced by way of grants. These sums represent the maximum Exchequer assistance for all three schemes.

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PART VI

The provisions of this part of the Act enable the Livestock Commission at the request of any body or bodies representing interests concerned with the several activities of the livestock industry to prepare a service scheme for one of the following purposes, namely, the encouragement, promotion or conduct of research and education; the collection and dissemination of statistics and other information; the insurance of livestock or products of the slaughtering of livestock; the advertisement of livestock or such products; the grading or marking of livestock or such products; the improvement of breeding of livestock; or any similar purpose.

Under a service scheme an authorized body would be constituted for the purpose of administering the scheme, and for undertaking the activities, or for arranging for the services and facilities for which the scheme was promoted. Provision is made for requiring all persons in the class of interests represented by the authorized body to contribute towards its expenses, but it will not be obligatory on such persons to pay also for services or facilities provided under the scheme unless such services or facilities are utilized. Before any scheme can be confirmed by the Minister concerned he must be satisfied, amongst other things, that there is a preponderating opinion in its favour amongst the persons liable for contributions, and that the scheme is desirable in the public interest.

Section 33 makes provision for a special type of service scheme that would facilitate the operation of livestock markets by-laws; in particular, such a scheme may constitute an authorized body representing auctioneers with power to license individual auctioneers to carry on their business in particular markets. Under this Section a service scheme may also be promoted with the object of compensating persons who suffer loss or damage by reason of the operation of livestock markets orders or by-laws.

PART VII

The provisions of this Part of the Act are purely financial and relate mainly to the Fund out of which the cattle subsidy is payable, and in general to the expenses of the Commission and Ministers. These and other relevant provisions of the Act are so framed as to render Parts IV, V and VI, individually, financially self-supporting, thus relieving the Cattle Fund, as far as possible, of liability under those Parts.

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PART VIII

This part contains general and supplementary provisions relating to the obtaining and disclosure of information, and such matters as inquiries, offences, validity of instruments and interpretation. In particular, Section 48 enables provision to be made in a livestock markets order or slaughterhouse scheme whereby permanent employees of a local authority may be compensated for any loss, for which no provision is made in any other Act, which arises from termination of employment or diminution of emoluments through the operation of such orders or schemes.

THE SCHEDULES

The First and Second Schedules contain incidental provisions relating to the constitution and procedure of the Livestock Commission and the Livestock Advisory Committee, respectively. The Third Schedule prescribes the procedure to be followed in connexion with the making of livestock markets orders. This procedure, generally referred to as provisional order procedure, affords the fullest protection for individual interests, and, in particular, provides that if an order is duly opposed by presentation of a memorial, the order cannot come into effect unless confirmed by Parliament. The Fourth Schedule sets out the procedure relating to the making of livestock markets by-laws. The Fifth Schedule prescribes the procedure to be followed in the submission and confirmation of slaughterhouse and service schemes. In all these instances the object of the provisions is to ensure that persons affected by these instruments should have full opportunity of making objection to the Minister and having their representations considered.

Appointment of the Livestock Commission. The members of the Cattle Committee appointed under the Cattle Industry (Emergency Provisions) Act, 1934, have been appointed by the appropriate Ministers to serve on the Livestock Commission. The names of the members are:

Lt.-Col. Sir John Chancellor, G.C.M.G.,
G.C.V.O., D.S.O. (*Chairman*)
Sir Francis Boys, K.B.E.
George Dallas, Esq., J.P.
Sir Robert Greig, M.C., LL.D., D.Sc.
Sir Harold Howitt, D.S.O., M.C., F.C.A.
Sir John Boyd Orr, D.S.O., M.C., M.A.,
M.D., D.Sc., F.R.S.
The Hon. Jasper Ridley, J.P., B.A.

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The appointment of two additional members to complete the personnel of the Commission is under consideration.

The Secretary to the Commission is Mr. H. Crow, O.B.E., to whom all communications should be addressed at 1, Sanctuary Buildings, Great Smith Street, London, S.W.1.

Subsidy Arrangements. The subsidy provisions (Part II of the Act), which come into operation on August 1, 1937, refer to a Subsidy Scheme, Regulations, and a Payment Order. The Minister of Agriculture and Fisheries, the Secretary of State for Scotland and the Secretary of State for the Home Department gave preliminary consideration to these instruments and issued their provisional conclusions in the form of a White Paper (Cmd. 5362) dated January 29, 1937. They have now had an opportunity of consulting the Livestock Commission constituted by them under the Act and have made or approved the necessary instruments.

The *Cattle Subsidy Scheme*, 1937, which deals with the administrative machinery for the grading and certification of eligible animals, has been drawn up by the Livestock Commission and submitted by them to Ministers, who have approved the Scheme by an Order under Section 5 of the Act. The methods by which the subsidy will be administered follow very closely on the lines of the existing Arrangements made under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936. In addition to changes of a minor character necessitated largely by the grading of animals to two standards and the payment of differential rates according to grade, the Subsidy Scheme provides for a slight increase in the fees payable by producers when their animals are certified. Some such increase was envisaged in the White Paper in view of the additional work that will be thrown on to Certifying Authorities and Certifying Officers as a result of the introduction of a second grade standard. At Live Weight centres the fee chargeable to producers will be increased to 1s. 8d. per animal certified, a fee of 9d. being chargeable in respect of an animal presented for certification and examined but not actually certified. At Dead Weight centres the fee for an animal certified will remain at 2s. while the fee for an animal presented and examined but not certified will be 9d.

The *Cattle Subsidy Regulations*, 1937, which define the descriptions of eligible animals and the manner in which weight shall be computed for the purposes of payment, have been made by the Ministers under Section 6 of the Act after consulta-

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tion with the Livestock Commission. Two standards are defined, the ordinary standard and the quality standard, to which fat cattle must conform in order to be eligible for subsidy at the appropriate rates. The Regulations also prescribe maximum carcass weights on which subsidy may be paid, equivalent to those prescribed for live animals.

The *Cattle Subsidy Payments Order, 1937*, made by the Ministers under Section 4 of the Act, prescribes the rates of subsidy payment on animals in each category. The rates are as follows:—

			<i>Animals per cwt. (live-weight)</i>		<i>Carcasses per lb. (dead-weight)</i>
<i>Ordinary Standard</i>					
<i>Animals :</i>					
Home-bred	..	..	5/-	..	1d.
Imported	..	..	2/6	..	$\frac{1}{2}$ d.
<i>Quality Standard</i>					
<i>Animals :</i>					
Home-bred	..	..	7/6	..	1 $\frac{1}{2}$ d.
Imported	..	..	5/-	..	1d.

These rates are so adjusted as to give further encouragement to the production in the United Kingdom of good quality fat cattle. They place a premium upon home-bred fat cattle of eligible qualities and indicate that it is the Government's desire as far as practicable to encourage the home breeder to improve and develop his beef cattle herds. The rates will operate as long as the present Order remains in force and will be kept under close review by Ministers in consultation with the Livestock Commission and the Treasury.

In order to ensure the due making of subsidy payments the *Cattle Subsidy (Marking of Imported Cattle) Order, 1937*, provides for the marking of cattle imported into the United Kingdom on or after August 1, 1937. In effect, the present arrangements for marking such animals are to be continued.

Copies of the Subsidy Scheme (S.R. & O. 659), Regulations (S.R. & O. 660), the Payments Order (S.R. & O. 658), and the Marking Order (S.R. & O. 661) may be purchased (price 4d. for S.R. & O. 659, and 1d. each for the others, exclusive of postage) through any bookseller or direct from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, London, W.C.2; 120, Great George Street, Edinburgh, 2; 26, York Street, Manchester, 1; 1, St. Andrew's Street, Cardiff; and 80, Chichester Street, Belfast.

FOURTH INTERNATIONAL GRASSLAND CONGRESS

The Fourth International Grassland Congress was held between July 8 and 23, under the presidency of Professor R. G. Stapledon, C.B.E., (Director, Welsh Plant Breeding Station). The Congress commenced with enrolment of about two hundred delegates at Rhodes House, Oxford, on Thursday, July 8 (Options 2 and 4). On the same evening, His Majesty's Government entertained these delegates to dinner in Christ Church, when the Earl of Feversham presided. The next day, the party made a tour of the Thames valley and Chiltern districts, visiting Lord Astor's estate at Cliveden in the afternoon. On Saturday morning, July 10, the party left on a tour through representative grassland areas of south-east and central England and on through Herefordshire to Aberystwyth. The Institutes visited included the Rothamsted Experimental Station, Northampton Institute of Agriculture, Moulton, and the Royal Agricultural College, Cirencester. After visiting seed-production areas in Herefordshire, on Tuesday, July 13, the party reached the Cahn Hill Improvement Scheme at mid-day on Wednesday. After inspecting the experiments on the Cahn Hill lands the delegates reached Aberystwyth on the same evening.

Another party of delegates (Options 1 and 3) enrolled in Aberystwyth on the same morning and also toured the Cahn Hill lands on Wednesday afternoon, but without joining the Oxford party.

On Wednesday evening the first full meeting of the Congress was held at the Parish Hall, Aberystwyth, when addresses of welcome were given by His Worship the Mayor of Aberystwyth, Mr. C. Bryner Jones, C.B.E., Welsh Secretary of the Ministry of Agriculture, and the Rt. Hon. Viscount Bledisloe, G.C.M.G. These were followed by the presidential address given by Professor R. G. Stapledon.

The large number of papers offered for presentation to the Congress were divided into Plenary and Sectional Sessions. The first Plenary Session was held on Thursday morning, when H. E. Woodman discussed the nutritional aspects of grass-drying, describing the research carried out at Cambridge since the 1925 season. This was followed by a paper on mountain pasturing of young cattle by V. Vezzani and E. Carbone, Italy (read by V. Vezzani) and a paper by Hedley R. Marston,

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Australia, on the nutritive value of pastures for wool production, in which stressed the necessity for a more complete collaboration between workers concerned with agrostology and animal nutrition.

The second Plenary Session on Saturday morning, July 17, was devoted to a series of papers on plant breeding and related subjects. P. V. Cardon, chairman of the U.S.A. delegation, described the extensive plant breeding programme now under way in the United States, and he was followed by papers on Swedish research by N. Sylvén and H. Osvald. T. J. Jenkin, Great Britain, discussed the research carried on at the Welsh Plant Breeding Station, on strain-building in the herbage grasses, and was followed by T. E. Miln, Great Britain, who dealt more particularly with the seed production of these pedigree grasses. Mr. Miln stated that "there is no doubt that there is ample scope for the extensive use of pedigree grass and clover seeds in Great Britain, and it is pleasing to realize that steps are being taken to form a new Association comprising various seed houses and seed growers with the guidance and help of the Welsh Plant Breeding Station. The seed trade will adopt the Aberystwyth pedigree strains and expects the farmers of Great Britain to co-operate by undertaking to grow seed crops on an extensive scale. It is greatly to be desired that all such seed crops be grown at home, and inasmuch as the growing of pedigree grass seeds in Great Britain is a new undertaking for our farmers, those who are willing to grow can depend upon co-operation in full from both the seed houses for whom they grow and the staff of the Welsh Plant Breeding Station."

The more technical aspects of cultivating pasture types of grasses for seed were described by Gwilym Evans, Great Britain, in a paper to the plant breeding and seed production section.

The Third Plenary Session contained papers of more general grass land interest. The Session was opened by E. Bruce Levy, New Zealand, who described the conversion of rain forest to grass land in that country; the area of forest felled and sown is approximately 14,000,000 acres, of which 12,000,000 acres have been more or less successfully grassed. The same topic was the subject of an illustrated lecture given by E. Bruce Levy on the evening of July 16. A. I. Virtanen, Finland, followed with a description of the important research in progress at the Biochemical Laboratory in Helsingfors, on

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the associated growth of legumes and non-legumes. This paper contained a chemical explanation of the old-established fact that non-legumes benefit by an association with legumes. L. E. Kirk, U.S.A., gave an evaluation of some species of grasses and legumes under Canadian conditions, discussing, in particular, red clover associations, white clover associations and lucerne associations. C. R. Enlow, U.S.A., outlined the pasture improvement programme developed by the Soil Conservation Service in the United States. Illustrations of this work were given in a lantern lecture which followed that of E. Bruce Levy. The Plenary Sessions concluded with a paper by E. Klapp, Germany, on the effects of frequent mowing and frequent grazing on different types of swards and upon different pasture species.

On Friday, July 16, the conference was divided into six sections, which discussed the following aspects of the grass land problem.

1. GRASSLAND ECOLOGY, INCLUDING RANGE MANAGEMENT.
President : Dr. J. D. Tothill (Uganda).
Vice-Presidents : Dr. E. Wyllie Fenton (Great Britain).
Dr. R. Wecke (Germany).
2. SEEDS MIXTURES.
President : Dr. C. K. van Daalen, Holland.
Vice-Presidents : Dr. D. B. Johnstone-Wallace (U.S.A.).
J. N. Whittet (Australia).
3. PLANT BREEDING, GENETICS AND SEED PRODUCTION.
President : Dr. G. Nilsson-Leissner (Sweden).
Vice-President : T. E. Miln (Great Britain).
4. MANURES AND FERTILIZERS, SOIL ASPECTS OF GRASS LAND.
President : Professor G. W. Robinson (Great Britain).
Vice-Presidents : Dr. H. J. Frankena (Holland).
J. M. Caie (Great Britain).
5. NUTRITIVE VALUE OF PASTURES ; FODDER CONSERVATION.
President : Dr. O. McConkey (Canada).
Vice-Presidents : A. B. Fowler (Great Britain).
Dr. W. Kirsch (Germany).
6. PASTURES. MANAGEMENT, YIELDS AND ECONOMICS.
President : Professor H. Osvald (Sweden).
Vice-Presidents : Martin Jones (Great Britain).
Dr. R. Geith (Germany).

Papers on range management in Section 1 were read by J. W. Rowland, South Africa, and W. R. Chapline, U.S.A. Both readers stressed that a re-orientation of the principles of arid land farming must come about, so that the farming enterprise will not only pay the individual, but be governed by a full consideration of the land, in the light of complex interrelationships between the soil, the plant and the climate.

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K. T. Kolbai and J. von Piukovich discussed the grassland problem in Hungary, where increasing attention is now being given to the grass lands of that country. There are now three Grassland Unions in Hungary, with 60,000 farmer members, so that, although the soil conditions and climate of the country are very unfavourable from a pasture point of view, interesting results may be expected as a result of this increased interest in grass land. J. de Carvalho e Vasconcelos, Portugal, described the grassland regions of his country, which are of particular interest since Portugal has zones of the highest and lowest rainfall in Europe. Continuing Section 1, three papers by British readers (R. A. Roberts, G. H. Bates and E. Wyllie Fenton) dealt respectively with trends in semi-natural hill pastures from the 18th century, life forms of pasture plants, and the value of certain mosses in detecting old woodland sites. The final paper in Section 1 was given by J. E. Senaratna, Ceylon, on the grass lands of Ceylon in relation to rainfall.

The opening paper in Section 2 was given by D. B. Johnstone-Wallace, U.S.A., who described his experiments at Cornell University on the influence of wild white clover on seasonal production and chemical composition of pasture herbage, and upon soil temperature, soil moisture and erosion control. Then followed an Australian paper by J. N. Whittet, New South Wales, who described the success of light seedings of pasture plants, particularly in areas of relatively light rainfall. L. Rinne, Esthonia, described his experiments on seeds mixtures for cultivated meadows on low moor, and D. H. Robinson, Great Britain, suggested mixtures suitable for poultry turf. Further papers on seeds mixtures were read by C. K. van Daalen, Holland, M. T. Thomas, Great Britain, and W. M. Findlay, Great Britain.

In Section 3 the genetics of red clover were discussed by R. D. Williams, Great Britain, the breeding of herbage plants by O. Valle, Finland, and the new varieties of subterranean clover in Western Australia by A. B. Adams.

After a visit to the breeding gardens of the Welsh Plant Breeding Station to discuss technique with T. J. Jenkin, the section concluded with a paper by Gwilym Evans, Great Britain, on growing pasture types of grasses for seed, a similar paper by C. L. Behm and a description of the grassland pests of the Midland Counties of England by A. Roebuck.

Section 4 opened with an important paper, as far as British agriculture is concerned, by J. A. Hanley on the need for lime

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and phosphate in grassland improvement; deficiency in these two substances is still the outstanding trouble with most of the grass land in England and Wales. An important point in this paper is the fact that at Cockle Park, where response to basic slag is very marked, the recovery of phosphoric acid in the herbage is only of the order of 10 per cent. The second paper in this section was by R. G. Heddle and W. G. Ogg, Great Britain, (read by the former), who described experiments designed to obtain exact information with regard to the standards of fertility required by the various pasture plants. Further papers in this section dealt with the manuring of grass land in arid regions (N. von Bittera, Hungary), the effects of fertilizers on the soil, the botanical and chemical composition of the herbage and the seasonal and total production of grass land in Connecticut (B.A. Brown, U.S.A.), the influence of potash manuring on the protein economy and production of organic matter in the plant (O. Eckstein, Switzerland), and a description of the soils of Wales by G. W. Robinson, Great Britain. The profitability of employing nitrogenous fertilizers on pastures was the subject of a group of four papers delivered respectively by G. Göbel, Sweden, H. J. Frankena, Holland, A. Biederbeck, Germany, and K. Schneider-Kleeberg, Germany.

In the opening paper of Section 5, O. McConkey, Canada, stated that a programme designed to raise soil fertility, particularly in available minerals and especially in phosphorus, must accompany improved fodder production in Eastern Canada, because surveys of the mineral content of pasture and hay gathered in different areas of the region showed that a considerable percentage of these fodders is too low in the essential minerals to maintain animals in health. T. W. Fagan and R. O. Davies, Great Britain, discussed the chemical aspect of the grassland research carried out in co-operation with the Welsh Plant Breeding Station since 1922. F. König, Germany, discussed the influence of different manurial treatment upon the composition and value of the herbage of permanent grass land, and Ll. I. Jones, Great Britain, compared the various herbage plants in Wales on the basis of their value as animal fodder. O. Jääskeläinen described the system of feeding young cattle in west Finland, where scanty stall feeding combined with the use of good pastures is very profitable, because the production cost of the pasture food unit is only one-half (and even less) of that of the food unit used during the winter. A paper that

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attracted considerable interest in Section 5 was the review of the history and present position of artificial drying of grass in Great Britain by E. J. Roberts. The Section also contained a group of three papers on various aspects of ensilage, by E. Crasemann, Switzerland, S. J. Watson, Great Britain, and W. Kirsch, Germany.

In Section 6, R. Geith, Germany, gave a report on the results of a study that was undertaken as a result of a resolution passed at the Third International Grassland Congress in Zürich in 1934, to the effect that the norms used in determining the yield of animal products from a pasture should be subjected to thorough investigation. Winifred E. Brenchley, Great Britain, read a paper on the correlation of manuring and botanical composition of continuous hay crops, describing the plots that had been seen by some delegates on their visit to Rothamsted on July 10. This was followed by two American papers, namely, H. D. Hughes, Iowa, on the response of *Poa pratensis* to different harvest treatments, measured by weight and composition of forage and roots, and R. H. Lush, Louisiana, on seven years' results of monthly clipping of pastures. G. H. Holford, New Zealand, then gave some pasture observations in New Zealand, which were illustrated by a colour film. John Orr, Great Britain, stated in his paper on the economics of grass cultivation that "figures obtained in the summer of 1936 showed that grass aged from one year to sixteen months produced much more milk per acre than grass of greater age, and other figures suggested that grass from two months' old to five months' old produces more milk per acre than grass of twelve to sixteen months, and it produces it in the late summer. Different records show, and in some cases suggest, that fields which are ploughed, which receive generous dressings of fertilizers on the surface of the ploughed land, on which a good seed bed is made by the harrow, on which good grass and clover seed is used, gave the largest return as an investment. This experience is consistent with the *a priori* reasoning in economics that in a process of manufacture the first instalment of capital should be supported by the second, and the second by the third and so on until the co-operating factors are complete. Instead of being relegated to a secondary, or even inferior, rank among crops, grass should be brought to the very front and receive as much attention as any arable crop has ever received. The justification is that this pays." Martin Jones, Great Britain, described his studies on the effect of grazing on

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the various constituents of the sward and the way in which systems of farming influence the grass land, causing certain species to dominate over large districts. D. M. de Vries, Holland, compared certain methods of determining the botanical composition of hay fields and pastures.

In addition to the tour already mentioned to the Cahn Hill Improvement Scheme, delegates visited the plots of the Welsh Plant Breeding Station on Friday, July 15, and again on Sunday, July 18. Other tours were also arranged for that Sunday morning. A comprehensive exhibit of the various aspects of the grassland research in progress at the Welsh Plant Breeding Station was staged in the buildings of the University College of Wales, Aberystwyth, where the Sectional Meetings were held.

On Sunday, July 18, one party of the delegates (Options 3 and 4) left for the north of England and Scotland; Cockle Park was visited on Monday, and a tour was made through various grassland areas in Northumberland. The party then proceeded from Newcastle to Edinburgh, which was reached in time for lunch on Wednesday, when the afternoon was spent inspecting the experiment farm of the Edinburgh and East of Scotland College of Agriculture at Boghall, or the work of the Scottish Society for Plant Breeding at Corstorphine. On Thursday, an extensive tour was made through the Central Plain, the southern part of the Central Highlands and the Trossachs, and the Congress concluded with a luncheon given by His Majesty's Government at the North British Station Hotel, Edinburgh, on Friday, July 23, when Mr. H. J. Scrymgeour Wedderburn, M.P., Parliamentary Under Secretary of State for Scotland, presided.

The Congress was attended by about 450 delegates from thirty-seven countries. The largest representation from abroad came from the United States of America, indicating the rapidly increasing interest in grass land in that country since the ravages of soil erosion became so marked. The British delegates were about 250 in number, and were representative of a wide range of interests. In addition to persons connected with grassland research, there were also numerous farmers and representatives of the seed trade, fertilizer industry and the implement manufacturers.

Particular reference should be made to the excellent hospitality offered to the delegates by official bodies and private persons at various points along the route of the Congress

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tours, and in Aberystwyth. The large numbers of delegates from countries overseas were much impressed by the warmth of the welcome they received, and will carry back with them many happy memories of a successful tour.

At the general meeting of the International Grassland Congress Association on Friday, July 16, Dr. Huizinga of the Netherlands repeated the invitation, already given at the Third Congress at Zürich, to hold the Fifth Congress in the Netherlands in 1940. The invitation was gratefully accepted and Dr. Huizinga was elected President of the Fifth Congress. The Congress was invited by Count Teleki of Hungary to hold its Sixth Meeting in that country in 1943.

A volume of Abstracts (in English and German) of all papers read at the Fourth Congress is available from the Joint Secretaries, Fourth International Grassland Congress, Aberystwyth, for 5s. The full Report will be published as soon as possible and should be ready in October; the price will be £2 per copy, or 35s. to buyers who have already purchased the Abstracts.

IMMATURE GRASS AND YOUNG SWARDS—II.*

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Data on Carrying Capacity. Having produced evidence as to the chemical composition and yield of foggages it will be of interest to examine such data as we have available relative to carrying capacity. Data from a number of different fields will be given.

The Bank. This field (2.91 acres) was sown out on June 5, 1934, in plots consisting of simple mixtures with wild white clover; indigenous strains of rye-grass and cocksfoot accounted for most of the area. A nurse crop was not employed, and the field was grazed for the first time $8\frac{1}{2}$ weeks after sowing. It was rested for the production of winter grass as from October 23, when it received 1 cwt. nitro-chalk per acre.

From March 25 to April 23, 1935, the field was grazed continuously with Kerry Hill ewes and their lambs.† During this period the field carried the equivalent of eight sheep per acre; the ewes remained in splendid condition, giving an abundance of milk to their lambs.

From February 28 to March 31, 1936, the field again carried the equivalent of eight sheep per acre. It had been grazed lightly during the previous September and October, and was completely rested as from the beginning of November.

Pond Field. This field (1.49 acres) was sown out on May 22, 1933, half in a simple mixture consisting of indigenous strains of meadow foxtail, red fescue and cocksfoot, and the other half in indigenous strains of meadow foxtail, red fescue and tall fescue, wild white clover being sown over the whole field. A nurse crop was not employed, and the field was grazed for the first time eleven weeks after sowing. It was rested from September 13 to December 15. The winter grass was converted in two periods, from December 13 to 20 and from March 21 to April 4. During these two periods, 23 days in all, the field carried the equivalent of 17 sheep per acre.

* The previous article appeared in the issue of this Journal for July, 1937.

† The weight of the ewes employed in these experiments was from about 110 lb. to 120 lb.

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Lane Field. This field was sown out on June 19, 1936, in a number of simple mixtures all including wild white clover. The number of species was considerable, about one-eighth of the field being devoted to indigenous perennial rye-grass. The field was sown without a nurse crop, and was not grazed at all from the date of sowing until the middle of December. By this date a considerable foggage had developed, and for some of the species it was badly burned. Grazing was started in the middle of December and was conducted by resort to movable folds taken over the whole field. From the middle of December until the end of March, the field carried four wether sheep per acre continuously.

Orchard Field. This field had been sown down in 1933 without a nurse crop. Half the field was sown in plots of commercial perennial rye-grass and the other half in plots of indigenous rye-grass, and crested dogtail and wild white clover were sown on all the plots. The field, which had been used only as a pasture, was not employed for winter grazing until 1936-37 when the sward was coming into its fourth harvest year. It had been rested from August 24, and wintered grazing was started in the middle of December. The folding method of grazing was employed, and from the middle of December until the end of March the field has continuously carried six in-lamb ewes to the acre in excellent and improving condition, an abundance of green rye-grass leafage being available to the sheep throughout the period.

Penwenallt. This field is now coming into its fifth harvest year. It had been sown out in plots consisting for the most part of indigenous rye-grass and indigenous cocksfoot; half of the plots also included wild white clover, while no clover was sown on the remaining plots.

For the past winter (1936-37) the field had been rested from August 24, and winter grazing was started on December 21. The folding method of grazing was again adopted. On the with-clover plots five ewes per acre were continuously and successfully carried from December 21 until the end of March, four ewes to the acre having been so carried on the without-clover plots.

Spaced Single Plants of Cocksfoot. In connexion with the breeding of cocksfoot, considerable areas are set out in spaced single plants. These plants are cut back after flowering time and then allowed to grow up into foggage. A tremen-

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dous bulk of fodder is thus developed and if allowed to carry into the winter the leafage will be partially burned and dead and partially green and growing. In the winter of 1934, $1\frac{1}{2}$ acres of cocksfoot in this condition were available, and since keep was short that year sheep were given access to the area. Between February 23 and March 24 thirty-two sheep per acre were maintained wholly on this fodder for no less than twenty-four days. Unfortunately no record was taken of the bulk of fodder available and no samples were taken for chemical analyses. In view of what we have said as to special timothy rows, this result is, however, well worth recording, and the more so since cocksfoot is by no means an ideal foggage grass, for even the indigenous strains winter burn (and particularly when allowed to grow right away) far more badly than do indigenous rye-grass, indigenous meadow foxtail or indigenous timothy. This little bit of evidence does, however, suggest that even foggage of decidedly low quality, if not downright unpalatable and if present in great bulk, is of very real value as a standby in severe winters.

Practical Suggestions. Speaking in terms not only of the present results, but of our whole experience of grass land, it would appear that the foggage from young and comparatively young leys (say not older than 3-4 years) is superior to that from permanent pastures in both chemical properties and in carrying capacity. Unfortunately we have only been able to test carrying capacity in terms of sheep, in regard to which stock the figures are very striking, and afford ample justification for advocating this method of dealing with grass land. The results incidentally stand very much to the credit of winter protein. It would be premature to suggest a correct date for closing fields, and this will always depend upon circumstances. The date should probably, however, be never earlier than August and seldom later than the middle of September. It is the fact, however, because of the quicker growth made by young leys, that the date of putting leys up can be considerably later than would be applicable to permanent pastures, for as we have seen, good yields of excellent winter grass can be obtained from leys put up as late as the end of October. It is also the fact that leys that have been heavily impregnated with stock nitrogen can be put up earlier than those not so manured and still provide winter green foggage of high protein content.

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If the chief grass on permanent pastures is bent (readily burning), the date of putting-up should probably be later than if the chief grass is rye-grass. For most purposes it is better to aim at good foggage than at poor foggage, even at the cost of reduced yield, but the value of relatively poor foggage in sufficient bulk is manifestly considerable in time of unusual winter shortage. The whole question of a just compromise between bulk and quality is one that demands extended research; it is to be remembered, however, that the accumulation of excessive bulk reacts adversely upon the continued excellence of a sward.

In our experience, better foggage is obtained after pasture than after hay—the “stock nitrogen” resulting from grazing having a profound influence on the production of winter grass and upon its winter greenness. If we consider the evidence from all the grassland experiments conducted at Aberystwyth, there is every reason for thinking that to take hay one year (this to encourage root development) and to graze the following year, putting the field up in August-September, would be the correct procedure to follow to ensure the maximum production of foggage of maximum quality. It should be added, however, that pasture leys used year after year for foggage—provided they have been well phosphated, and despite a yearly application of nitro-chalk in August or September, and despite also the very heavy late winter-early spring grazing—have been maintained in excellent sward with an abundant clover contribution. Indeed, this method of grazing—the leys are never grazed excessively hard in the summer—appears to represent exceedingly sound pasture management from the point of view of both the animal and the sward, at any rate as regards leys not intended to be left down for longer than about four years.

The Production of Grass at Difficult Periods During the Summer. In an exceedingly important paper on “Grass and Money,” Orr* remarks that “one of the first things to do is to contemplate the abolition of the ‘nurse’ crop,” and on financial grounds he completely justifies “abolition” on the farms with which he has been concerned. As will have been apparent from the examples quoted in the previous section, at Aberystwyth we have long since abolished the

* Orr, John, Grass and Money, *Scottish Jour. Agric.*, Vol. XX, No. 1 January, 1937.

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nurse crop (as ordinarily understood) and we are convinced with results that are beyond reproach from the financial point of view. The advantages of abolition are threefold: (1) establishment of an excellent sward (more than ever essential if we are thinking in terms of 4-6 year leys) will be the more rapid and the more certain; (2) the spread of wild white clover will be rendered practically certain and will be greatly hastened; and (3) abundant succulent and nutritious grass will be produced at a time of the year when such grass frequently tends to be scarce—in July and August, and, as we have already seen, in the winter.

It is this last point that needs to be the most strongly emphasized, for by providing grass in July-August, and in the winter, we have an admirable and safe way of paying for our seeds mixture in terms of feed, the equivalent of which is always expensive to buy in. Our practice at Aberystwyth is to graze our developing leys as soon as reasonably possible after sowing, and it is in order to assist to this end that we almost invariably include Italian rye-grass in our mixtures. Italian rye-grass is in fact our nurse. As before mentioned, we have conducted all our experiments with sheep, but we have been informed of many instances where dairy cows have been turned on to the maiden leys in July or August with markedly beneficial results on the milk yields. In a favourable year maiden seeds unhampered by a nurse come away with great rapidity, and make quite exceptionally lush growth. So rapid and spring-like is the growth, and so excellent the feed that it would seem not unlikely that the protein so developed has about it properties more akin to "spring" than to "autumn" protein; detailed investigation relative to this is urgently necessary. During the past ten years or so we have grazed maiden leys for the first time most usually within eight to twelve weeks of sowing the seeds mixture; on rare occasions we have actually grazed within no more than six and a half weeks of sowing date.

Examples of Stocking. A few examples of the stocking on fields so treated will now be given.

Spring Field. This field was sown on May 5, 1936, in various plots consisting largely of indigenous strains. It was grazed for the first time eight weeks after sowing. From June 29 to August 3 it provided three grazing periods and

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carried the equivalent of six and one-third sheep per acre for the thirty-five days.

Pond Field. This field has already been referred to. It was grazed eight weeks after sowing, and from August 16 to September 13 in two grazing periods of fifteen days in all it carried the equivalent of eleven sheep to the acre for the full period of twenty-nine days. This field was first grazed on August 16, 1933, and it has been used only as a sheep pasture ever since. During the period up to October 9, 1936 (three years fifty-three days), the field has carried the equivalent of four and a half sheep per acre per day throughout—this including very satisfactory periods of winter grazing. The full stocking results are given to show that the methods of managing leys here under discussion manifestly do not lead to sward deterioration, despite excellent carrying capacity. The grazing is always and at all times of the year intermittent—"on" and "off" is the golden rule.

The Bank. This field, which has already been referred to, was grazed for the first time eight and a half weeks after sowing. It provided three grazing periods from August 4 to October 23, and in this time afforded keep for the equivalent of nearly five and one-quarter sheep per acre for the full eighty days.

Lodge Field: Cahn Hill Improvement Scheme. This field of ten acres standing at about 850 ft. above sea level was sown on May 12, 1936, and was grazed for the first time within seven and a half weeks. It had been sown with a mixture consisting chiefly of indigenous perennial rye-grass (S.23) and wild white clover—of course with a generous addition of Italian rye-grass. The field was grazed intermittently from July 3 to September 14, and during that period as a whole actually carried the equivalent of 8.4 Welsh mountain sheep to the acre. This stocking was advisedly exaggeratedly heavy because it was desired to test the influence of ultra-hard grazing on the sward. The growth was unusually abundant and six sheep per acre for the period would have been a lenient stocking. After this hard grazing the field was dressed with C.C.F. (No. 4) and rested until the end of March, when the sward was looking remarkably well and already full of wild white clover with a most inviting bite offering for ewes and lambs. The hard grazing had done no harm and all the indications are that it had done a great deal of good.

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Other Methods. Just as grass can be laid up to provide winter keep, so can the grazing management be adjusted to provide grass at other wanted-times-of-the-year from fully established leys. Equally, seeds mixtures can be designed to provide pre-eminently for particular periods of the year. It is beyond the scope of this article to discuss this matter in detail, but an example will suffice to illustrate what can be achieved. A simple seeds mixture based predominantly on indigenous perennial rye-grass, will give a sward which, in some years, tends to go short in July and August. Recent trials at Aberystwyth have shown that a very satisfactory, simple mixture for grazing purposes is one composed predominantly of indigenous timothy (S.48 and S.51) and indigenous meadow fescue (S.53) with rough-stalked meadow grass and wild white clover. Thus compounded, and without competitive interference from either rye-grass or cocksfoot, both the timothy and meadow fescue establish themselves quite satisfactorily. The sward thus developed is complementary to a predominantly rye-grass sward (it is equally palatable), in that it is highly productive during July and August and indeed retains a high level of productivity throughout the season.

The Influence of Climate. The rainfall in the Aberystwyth district is of the order of 40 in. per annum, and consequently it would be dangerous to assert dogmatically that the practices here discussed would be equally successful in regions of materially lower rainfall. We have, however, had our dry years as well as our wet years, and it is true to say that during the whole period of our critical experiments with leys (seventeen years) we have never had an irreparable failure of "take." The "takes" are not always perfect, and it is not always possible to graze within about ten weeks of sowing, but with a 4-6 year ley it is not very much to lose the first July-August grazing. From correspondence and discussion with interested persons, it is, however, quite evident that practices very similar to those we have discussed are in fact successfully employed by knowledgeable farmers operating under a rainfall very appreciably less than that of the Aberystwyth area. Be this as it may, in an average year, 24 per cent. of the land surface of England and Wales receives over 40 inches of rain, while in a "wet" year the area thus "favoured" exceeds 60 per cent. It is true

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that a large proportion of the " 40-inch " area represents rough and hill grazings; even so, there remains a very considerable acreage, in the aggregate pre-eminently suitable for the farmer to avail himself of the innumerable advantages which first-class and cleverly managed leys offer him. The ley is the key to bringing the plough as a money-earning implement into districts where at present it is entirely unknown or but rarely seen. In an ordinary year 28 per cent. of the land surface of England and Wales is subjected to a rainfall of from 30 to 40 inches; in all probability it is this very area which under skilled management affords the greatest scope for successful and highly remunerative ley farming.

Thanks are not only due to Professor T. W. Fagan, but also to my colleagues Mr. Iorwerth Jones, Mr. Moses Griffith and Mr. Milton, who have provided data which have been drawn upon in the preparation of this article.

[*Concluded.*]

RECENT CHANGES IN SHEEP BREEDING IN THE ARABLE AREAS—I

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The decline in the sheep population of England and Wales is now a well recognized feature of English agriculture. The fall has been largely confined to the areas of arable sheep farming and in these districts two fundamental changes have accompanied it, the first in breeding policy, and the second in the aims and methods of production.

In 1867, the total number of sheep in England and Wales was just over 22 millions and numbers declined slowly up to the outbreak of the War. The fall was then accelerated and by 1920 the number was reduced to 13,382,673. Since that time, however, the population has partly recovered and the figure of 18,495,418 in 1932 was the highest level reached since 1911. Any comparison between the total numbers of sheep in recent years, however, cannot be an accurate record of the change in production. Marketing at an early age has brought about a striking change in the age distribution. Between 1910-12 and 1928-30 there was a fall of 42.6 per cent. in the annual average number of sheep over one year (excluding ewes) in this country, but sheep under one year old fell only by 9 per cent. A decline in numbers, in these circumstances, would not necessarily coincide with a decrease in the production of mutton and lamb. More lambs might be born, but if this were offset by their shorter average life, the sheep population would decline.

The best guide to the broad changes in the industry is the ewe population, and a comparison has been made over two periods of three years. In 1910-12, the annual average number of ewes in England and Wales was 7,431,995, and in 1928-30 it was 6,788,268, a decline of only 8.7 per cent. These figures indicate that the decline in breeding was less serious than the fall of 14.9 per cent. in the total number of sheep would suggest.

It is not possible, however, to obtain a true picture of the sheep farming in this country by reference to the population figures of England and Wales as a whole. Broadly speaking, there are two main divisions in the industry, (1) the grassland sheep industry, which includes the mountain and heath grazings, together with the rich pastures of Northamptonshire,

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Romney Marsh and the Devon valleys; and (2) the arable sheep industry, which covers the chalk belt from Dorset to the Wash, and the Lincolnshire and Yorkshire Wolds, together with the uplands of the Cotswolds.

A recent inquiry was directed to this belt of arable farming, and twelve of the more important arable counties, representative of arable sheep farming, were visited. These were Berkshire, Dorset, Hampshire, Wiltshire, Sussex, Hertfordshire, Norfolk, Suffolk, Gloucestershire, Oxfordshire, Lincolnshire and the East Riding of Yorkshire.

Before the War these counties fed hurdled sheep as the backbone of the farming system, and although the breeds varied, the central feature of the sheep farming was undoubtedly the production of crops on arable land for the feeding of ewes and the winter fattening of tegs. It is true that in Dorset the native horned breed produced lambs for the Easter market, and in parts of the southern chalk belt the Hampshire was sometimes kept for the same purpose, but elsewhere winter fattening was pre-eminent. In Berkshire, Hampshire and Wiltshire, the supremacy of the Hampshire Down was unchallenged; to the north-west, in Oxfordshire and Gloucestershire, the Oxford Down shared the premier position with the Cotswold. In Sussex, the Southdown and its crosses prevailed, while in East Anglia, the Suffolk had no rival. The popularity of the Down ewe, however, did not extend north of the Wash; in Lincolnshire the massive local Longwool was dominant, and farther north in the wolds of Lincolnshire and the East Riding of Yorkshire, the Leicester, another Longwool, was the most popular breed. Thus, although winter fattening was the main feature of arable sheep farming, yet the distribution of breeds was local, and almost each county was convinced that its breed was the best adapted to the prevailing conditions.

TABLE I.—SHOWING CHANGES IN THE NUMBER OF EWES IN ARABLE AND GRASSLAND COUNTIES IN ENGLAND AND WALES: 1910-12 AND 1928-30

	1910-12 Annual Average	1928-30 Annual Average	Percentage Change
Arable counties	1,883,395	1,175,117	- 37.6
Grassland counties*	3,845,666	4,148,736	+ 7.9
England and Wales	7,431,995	6,788,265	- 8.7

* Wales, Cumberland, Devon, Herefordshire, Northamptonshire, Northumberland, Somerset, Westmorland, Lancashire and the North and West Ridings of Yorkshire.

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Recent changes have had a disastrous effect upon the numbers of sheep in the arable areas. Whereas in the grassland areas the number of ewes increased by 7.9 per cent., the decline in the arable areas was no less than 37.6 per cent. Even this figure is heavily weighted by the inclusion of the East Riding of Yorkshire, where the number of ewes fell only by 11.6 per cent.; without the East Riding, the arable counties show a decrease of no less than 40 per cent. Berkshire shows the largest reduction with a fall of 51.9 per cent., followed by Wiltshire, Hampshire and Suffolk, with falls of 50 per cent., 48.4 per cent. and 45.6 per cent. respectively. The least fall is 21 per cent., in Gloucestershire, explained by the importance of grass sheep in the western half of the county.

This decline in numbers was accompanied by important changes in breeds. The Longwool breeds, the Cotswold, the Lincoln and Leicester have suffered most, but the pure Down breeds, particularly the Oxford and the Hampshire, have also declined. The production of arable crops for the breeding flock has been widely abandoned, and ewes of grass breeds have become increasingly popular. This has led to a striking increase in the practice of cross-breeding, and for commercial production crossbred ewes as well as lambs are extensively used. The changes have gone on side by side with an increase in the production of early lamb and of summer fat lamb. Generally, however, changes have been to less intensive systems, for winter fattening and the maintenance of ewe flocks on arable crops have everywhere declined.

At present, breeding policy in these areas is in a state of extreme confusion, but there are nevertheless some general principles underlying the recent changes. They may be summarized under the following headings:—

- (1) The change from the arable to the grassland ewe.
- (2) The decline in Longwool breeds.
- (3) The change in numbers and distribution of Down breeds.
- (4) The increase in cross-breeding at the expense of pure breeds for commercial production.

Arable to Grass Ewe. The distinction between the arable and the grass ewe is not always well defined. Many breeds of sheep are highly adaptable; both the Hampshire and the Suffolk, always associated with arable farming, have proved satisfactory as purely grazing ewes, while, on the other hand, the Scotch Half-bred, essentially a grassland sheep, can be huddled on roots without difficulty.

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The extent of the change has varied with climatic conditions and local prejudice, but in each of the twelve counties visited there was evidence of the spread of the grassland ewe. In a few areas, the popular breed of a quarter of a century ago was still the most numerous; in Dorset, for instance, the indigenous horned breed had no serious rival, and in East Anglia, the popularity of the Suffolk ewe had not noticeably been affected. In the Cotswolds, however, the native ewe had virtually disappeared, and the Oxford Down was struggling to maintain a footing in an area that was once a stronghold of hurdled sheep, but now maintains chiefly grassland ewes.

In Hampshire and Berkshire, the grass ewe had made considerable progress, while in Hertfordshire grassland breeding flocks were widespread. The greatest change, however, appears to be in Wiltshire, where hurdled sheep are fast becoming a rarity. Formerly, this area maintained hardly anything but flocks of pure-bred Hampshire Downs for commercial production, but their place has been taken by breeding flocks of Cheviots, Scotch Half-breds, Kerry Hills and Exmoors, together with crossbred ewes of every kind. The following table, compiled from the catalogues of the ewes offered at the famous August fair at Marlborough, between 1933 and 1935, gives some indication of the extent of the change:

TABLE II—BREED OF THE EWES OFFERED AT MARLBOROUGH SHEEP FAIR (AUGUST), 1933-35

	Cross- bred	Un- classified	Cheviot	Kerry Hill	Other Grass Ewes	Hamp- shire Down	Other Down Ewes	Total
Numbers ..	4,288	3,191	1,821	849	301	1,916	233	12,599
Per cent. ..	34.0	25.3	14.5	6.7	2.4	15.2	1.9	100

Formerly, the ewes offered at this fair were almost entirely of the Hampshire breed, but in these years all the Downs represented no more than 17 per cent. of the total. On the other hand, the Cheviot, the Kerry Hill and other grass ewes, together with the crossbreds, the majority of which are kept on pasture, amounted to nearly 60 per cent. It is not suggested, of course, that these figures are an exact guide to the distribution of the breeds of sheep in the South of England, but they provide a concrete illustration of the change.

In the choice of grass ewes, considerable difference of opinion was apparent even under conditions approximately the same.

CHANGES IN SHEEP BREEDING

The most widespread, undoubtedly, was the Scotch Half-bred, (Border-Leicester x Cheviot), for it had given satisfaction under a wide range of conditions. It thrived on the best pasture of the South and also in the exposed areas of the Cotswolds. In East Anglia it had been hurdled successfully on sugar beet tops, and further north in the wolds of Lincolnshire and East Yorkshire it had reacted favourably when treated as a semi-arable ewe for folding on roots. Its fertility, with an average lamb fall approaching 150 per cent., was a telling point in its favour as against the Hampshire, with little more than an average of one lamb per ewe. In addition, the Scotch Half-bred was very popular for crossing with Down rams in almost all arable districts. On poor and exposed grazings of the South, however, the Cheviot proved more hardy, and was well suited to the extensive system of sheep farming, which was first adopted, following the failure of the traditional arable sheep farming methods.

In Dorset, Wiltshire and Gloucestershire, the Kerry Hill was popular. It has proved fairly adaptable, while its small, compact carcass makes it a favourite with the butcher, particularly for the fat lamb trade. There was, however, no lack of originality in selecting grass ewes, and the Exmoor, Ryeland and Clun Forest were all found in the south. Farther north, the Mule and Masham, as well as the Half-bred, were spreading into the East Riding of Yorkshire from the west.

The reasons for the change were everywhere the same. Sheep farming on arable land has always had a two-fold object, the sale of sheep, and the manuring of the land for corn. If sheep held their own and corn was profitable, the system was satisfactory, but now heavy cash losses on the arable breeding and fattening flocks were not recovered in profitable corn prices. The system of hurdling is expensive, for labour costs are high at every stage; it is not merely a question of wages of the shepherd—for more important are the heavy charges for hand hoeing swedes and turnips. Again, the difficulties of arable farming and alternative methods of manuring may have exerted as great an influence as the fall in prices of mutton and lamb.

The change from the arable to the grass ewe entailed the virtual abandonment of the winter fattening of tegs, and a concentration on the production of fat lamb with its quicker returns. The ewes were left to fend for themselves on the pasture for nearly all the year and much labour was saved.

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The flock could be divorced from the management of the arable land, with its high running costs and low corn prices, and if the lighter soils suffered, on the stronger lands the change was sometimes beneficial, for the sowing of spring corn had no longer to wait upon the convenience of the shepherd, and rotations could be made more flexible to meet changing economic conditions.

The substitution of sheep breeding on grass for breeding on arable is undoubtedly a movement from an intensive to an extensive system, partly because an equal quantity of fodder cannot be grown, and partly because of the risk of disease when the plough is no longer following the flock to sweeten the soil. It has been an almost universal experience that for the first two seasons grass ewes have been surprisingly successful, and the temptation to increase numbers has often proved irresistible. The following experience of a farmer on the southern chalk downs is typical. The farm is one of just over 1,000 acres, and two-thirds were arable in 1920. At that time it carried a flock of 500 pedigree Hampshire Downs and fattened tegs. A decision was then made to introduce grass ewes, Kerry Hills and Cheviots being first tried, and the Cheviot-Ryeland cross ewe was finally adopted. Meanwhile 350 acres of arable were put down to permanent grass and the number of breeding ewes was increased from 400 to 650, but disease set in and the flock had to be reduced permanently to 400. Even this number could not be maintained without careful rotation of the grazing, while a limited amount of arable crops was also found necessary.

The danger of disease is very real, and it is interesting to note that many of the grass flocks have been introduced by migrating Scottish and North Country farmers, who have brought their native systems of management with them. This was particularly noticeable in Hampshire, where the local Down breeder was willing to abandon sheep farming rather than to change his methods. Indeed, one of the factors limiting the spread of the grassland flocks is the lack of knowledge of their management among arable farmers. Experts in their own line, they were not equally well versed in the ways and means of maintaining the health of grass flocks.

Whatever its immediate success, the grass ewe is not, however, a complete solution of the problems of sheep farming in arable areas. Because it can only be successful as an extensive system, it is unlikely that the spread of grassland sheep farming

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will lead to a substantial recovery in sheep numbers. Moreover, the risk of drought and the difficulty of securing good pastures may be insuperable obstacles to success in the drier districts.

Again, the high capital cost of establishing a flock of grass ewes and providing for replacements, particularly if half-bred gimmers have to be brought down from Scotland or Kerry Hills imported from Wales, inevitably leads to a heavy charge for depreciation, which may offset the lower costs of maintenance. On the other hand, the attempt to make the flock self-supporting has two disadvantages. First, the fact that the grass ewe is crossed with a Down ram makes it imperative that two separate flocks should be maintained, the one to provide ewe lambs for the breeding flock and the other for commercial production. It is no easy matter to carry this out even on the larger farms, but on the smaller ones it becomes well nigh impossible. Secondly, in the attempt to make the farm self-supporting, there is always a danger that the original characteristics of the ewe may be lost after it has been moved from its native environment. It insensibly adapts itself to new conditions and unless periodic introductions of fresh stock are made, some of the most valuable qualities of the breed may be lost.

Longwool to Down Breeds. The spread of grassland flocks has come mainly from the need for reducing costs of production, but it has been stimulated by a demand for a smaller joint, a leaner and better quality carcass. This has particularly affected the Longwool breeds, which are heavy, fat and slow maturing, while the fall in wool prices has particularly affected them. The Cotswold, Lincoln and Leicester have given way before the Down breeds on many farms. Thus, on the one hand, the Hampshire is disappearing before the Scotch Half-bred in Wiltshire, while at the same time it is taking the place of the Cotswold in Oxfordshire; likewise the Suffolk may supersede the Lincoln in Lincolnshire and yet in its home county it may give way to the grass ewe.

The Cotswold has suffered the most, and to-day it is virtually extinct in its native area. It has lost stamina through inbreeding, and now its only commercial use is for rams for crossing with Suffolk ewes in East Anglia. Even here, however, its future is doubtful, and the few remaining flocks may shortly have only an historical interest.

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The extensive use of seed leys in the feeding of the typical flock has made the Lincoln a semi-grass-ewe, and further, the influence of the export trade has helped to check its decline. In Lincolnshire, though reduced in numbers, it appears still to be the most widespread breed, but in the East Riding of Yorkshire it has almost disappeared.

The third Longwool to fall out of favour is the Leicester, which, though considerably smaller than the Cotswold and the Lincoln, has the reputation of being the fattest of the breeds. It is still the most popular ewe in the Yorkshire Wolds, where its hardiness is a great asset. Elsewhere it has declined, and as a pure breed its commercial usefulness is limited. Crossed with the Suffolk, however, it appears to give a satisfactory carcass and has thus obtained a fresh lease of life in a few areas.

[To be concluded.]

THE CULTIVATION OF ASPARAGUS FERN

W. E. SHEWELL-COOPER, N.D.H., F.L.S., *Dip. Hort.* (Wye)

The cultivation of asparagus for market has been going on for over 30 years, and there has sprung up quite a small industry, which is centred chiefly around the Swanley district, though the fern is grown commercially also in other areas.

Type of House. The type of house generally used is one that is 4 ft. 6 in. high to the eaves and 7 ft. 6 in. to 8 ft. to the ridge. The house will normally be 100 ft. long by 12 ft. wide, and six ventilators on either side of such a house should be quite sufficient. Ventilators are not used as much with *plumosus nanus* as they are with other crops; in fact, they are only used during hot spells when the house gets humid or when the days begin to shorten. Even at such times, only the ventilators at the middle or top of the house are opened, and not those at the bottom end.

Soil. It is quite evident that the main requirement of *plumosus nanus* is a well-drained subsoil, for the actual soil in which the plants are grown is specially composted for the purpose. The sub-soil in the Swanley District is mainly chalk, though a good gravelly sub-soil would undoubtedly do as well. The soil below the made-up bed should be porous and on the light side, and a light loam would be preferred definitely to a heavy clay.

Preparation of Soil. The compost of which the main bed is composed should consist roughly of two parts of well-rotted loam, one part of leaf mould rubbed through a half-inch sieve, one part sharp silver sand, one part wood ashes or very old coal ashes (if well consumed and well weathered), and one part old mushroom bed or well-rotted stable manure.

This material is put over the bed to a depth of 4 in. to 6 in., after the original top soil has been removed to a depth of 3 in. to 4 in. Well-rotted cow manure should be dug in just before the special compost is placed in position; 1½ tons will be sufficient for a house 100 ft. by 12 ft. In addition, 1 cwt. of steamed bone flour should be incorporated, though some growers prefer a coarse bonemeal because they consider it is more lasting. It must be remembered that the asparagus fern grower is preparing for a four-years' crop.

The manure is usually dug in 9 in. deep, that is a "spit" deep, and is thus a good way down when the planting mixture is placed on top. Bastard trenching is the normal method

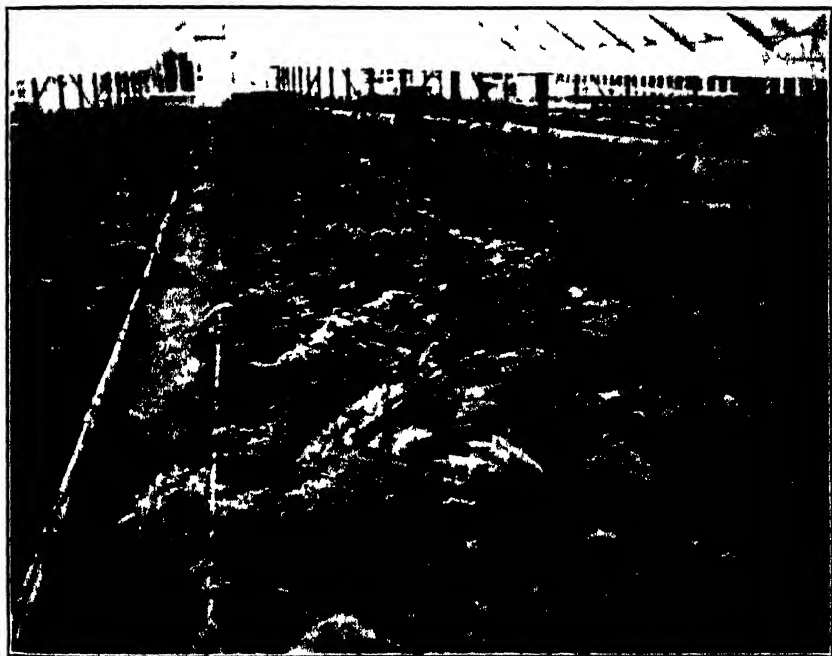


FIG. 1. A good house of Asparagus Fern. Note the centre path, the boards at the sides, and the raised heating pipes.



FIG 2 A box of "special" Asparagus Fern packed for market



FIG 3 — *Left* A bunch of best "short" *Right* A bunch of "selected"

Cultivation of Asparagus Fern

of preparing the soil. It needs about 120 barrowloads of planting mixture per house (the figures given hereafter will refer to such a house).

Modern thought tends towards the sterilizing of the planting mixture by baking, because it is feared that chrysalides of moths may be brought in with the leaf mould. Other insects and diseases would of course be controlled if the compost were heated to 210° F. for 20 minutes or so. Instead of the leaf mould it is suggested that fine peat might be used, and this certainly lasts longer in the soil.

Time. It is usual to lay down a house of fern in February or March because the fern planted at this time gets away quickly and goes on cropping in the early autumn.

Planting. In order to make planting easier, it is usual to place boards on either side of the beds to hold them up. Breeze blocks are sometimes used, but these are too porous and take up a good deal of moisture from the soil, so that there is a tendency for the plants near them to become dry.

The soil should be well watered before the plants are put in, and should be in such a condition that it is moist but not wet.

The heat should be turned on directly the planting soil has been wheeled in and spread, and after three or four days the beds should be sufficiently warm for planting. The temperature from this time will be about 60° F. during the day and 55° F. at night.

The central path will normally be about 18 in. wide and this should give about 4½ ft. of border on either side.

The asparagus fern, usually planted out of 3-in. pots, should be put in rows 6 in. apart, the plants being 4 in. apart in the rows. Firm planting is essential, and the ball should not be broken up when planted.

Some growers prefer to plant from boxes, to save labour, but the results are not so good, and the cutting of the crop is delayed two months. The plants should be put in a little lower than the level of the soil, since, as the asparagus grows, the crown generally rises. Further, deep planting makes it easier to water the plants. Asparagus fern should always be well watered in.

Watering. From this time onwards, very little water is necessary for the first couple of months, provided the atmosphere in the house is kept damp. In fact, if daily dampings or dampings every other day are given, it may not be necessary

CULTIVATION OF ASPARAGUS FERN

to water for three months, but after the first three months heavy watering may commence. A regular soaking should be given once a week, and it may take $\frac{3}{4}$ hour, with $\frac{1}{2}$ -in. water supply, to soak the soil in such a house properly. Very often such soaking means an application of 500 gallons. This is the heaviest watering that is normally required.

After this, damping down need only be done, say, every second day, and this merely means the hosing of the pathways and walls, a necessary operation that helps to keep down red spider and probably thrips.

Temperature and Shading. The temperature is kept as before, but when April approaches and the brighter days come, the house needs shading in preference to ventilating. If the ventilators are opened a darker-coloured fern is produced and the growth is retarded. A light-coloured fern is certainly preferred, especially in the London Markets. It is usual to use hydrated lime and water as a shade mixture and this should be thin enough to go through an ordinary syringe or sprayer quite easily. This shading should be removed about the middle of September when the nights get longer.

Fire heat may be reduced considerably by the end of April, and a little heat at night only will probably be necessary. Fire heat may be dispensed with altogether by the end of May, providing there is no wet cold spell at the time.

The fires should be started up again at the end of September and the heat used at night only at the outset. This is done to prevent damping and "fogging." Fogging causes the little tips of the fern to rot and the "pinner" are apt to drop from the lower part of the fern under such conditions. There should be just sufficient fire heat to take the chill off the pipes and keep down the damp, say only 50° F. at night.

At the end of October, the heat may be turned on again night and day, but even then only very little in the day. By the middle of November the full heat will be on day and night, the temperatures being kept at 60° F. and 55° F. as before.

Cultivation. During this time the soil should be cultivated in between the rows by the use of a light 3-pronged American hand hoe. This helps to keep down the weeds, aerate the soil and create a mulch. The borders should never be trampled on, and as much of the work as possible should be done from the central pathway. It may be necessary to hoe every third week until a good top growth is produced, which may be in about four months after planting.

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Top Dressings. There should be no need to give top dressings during the first two years. The base manures originally given in the compost can produce a really good fern without any "extras." After two years it is profitable to give dressings of superphosphate at 1 oz. to the square yard in between the rows about March. This should be well watered in. A dusting of steamed bone flour is sometimes recommended, but this is slower acting.

The main thing is to try and feed *Asparagus plumosus* without darkening it. It is impossible, for instance, to give nitrogen or potash without the fronds turning a dark green.

When the third year of cutting is reached, that is, when the bed is nearly four years old, a top dressing of a similar compost as originally used may be given. This time fine peat should definitely take the place of the leaf mould in the compost.

Cutting. About four months from the time of planting it should be possible to make the first cut. This is of course providing that decent fern out of 60's is planted. Cutting should not be too severe to start with and only the older and perfectly developed fronds should be removed at this time. Two or three growing fronds should always be left on a plant.

During cutting a sharp look-out should be kept for red spider and for caterpillars of the yellow or red underwing. The biggest flush comes about 6 months after planting and for 6 months after this. The best quality and the heaviest cut continues for about 12 months, beginning at the sixth month.

After the beds have been established 18 months a grower can begin to cut more of the longer fronds and less of the medium-sized ones. At the end of two years the growths begin to "trail."

The trails may be stopped at, say, 2 ft. in length or left to grow for cutting and marketing as trails, when the growths are generally 2 to 4 ft. long. Few growers bother to string their trails, but when this is done they do develop properly. The time and cost factors, however, need consideration.

Most growers stop the trails rather than allow them to grow; and at the point of the stopping spring a number of growths, each of which forms a nice backing to a spray or buttonhole.

Quite heavy cuts will be produced during the second and third years, and during the fourth year cropping will fall.

General Cultivation. Watering should continue all the time the plants are growing, although heavy watering is not necessary during the winter months except near the pipes.

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As the days begin to lengthen the borders should be cleaned. This is when the crop is at its lowest ebb and before the young shoots begin to come up from the crown again. The dead fronds and other matter such as liverwort, etc., should be cut away and the bed may be lightly "scratched" all over.

Removing. The bed should be removed about January at the end of the fourth year. This will be when the young plants are ready to take their place, and all the old roots should be removed because these go down fairly deeply. At this time the house can be repaired, the glass can be cleaned and woodwork painted again.

The Seed. In most instances the seed comes from Italy and the highest germination may be obtained from the first seeds harvested. It seems that *nanus* ripens its seeds in batches and in consequence these are harvested in batches. The grower should purchase the first batch, which is usually obtainable towards the first week in March. Occasionally the seed may not arrive until the end of April, that is if the harvest happens to be late abroad.

Seed Sowing. Some growers soak the seeds in warm water for several hours before sowing, but this is not really necessary. The seed, whether soaked or not, can be sown in two ways:—

1. In the ordinary seed box, 14 in. × 8 in. × 2 in., 150 seeds to a box.
2. Spaced out in deeper trays, 3 in. to 3½ in. deep, from which the *nanus* are planted into the borders direct.

Seedlings grown in the shallow trays should be potted up into 60's directly they are large enough to handle. This is usually in from six to eight weeks from the time of sowing the seed, providing the temperature can be kept at round about 60° to 70° F. It is not at all necessary to have bottom heat.

The boxes should be filled three-quarters full with a suitable compost, which should be firmed, after which the seeds should be spaced out and a sifting of the same sandy mixture placed over them and pressed down. The boxes should then be watered and the seed should germinate in from 3—6 weeks.

Composts. Some growers prefer to raise their plants in sand only, but this is not advised because the plants have nothing to "grow away" in after the seeds have germinated.

It is preferable to use a light sandy mixture. This should consist of, say:—

- ½ part of well-rotted leaf mould.
- ½ part of coarse silver sand.
- ½ part of well-rotted man.

This compost should be sterilized by baking.

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A similar compost should be used when potting the plants up into 60's, though most growers reduce the amount of sand and add 1 lb. of steamed bone flour to every barrow load of mixed compost. This mixture should be sterilized also.

Treatment of Boxes. Plenty of coarse material should be placed at the bottom of the boxes, to ensure good drainage. The boxes should never be allowed to get dry, and after the seed has been sown they should be shaded from the sun. This is usually done by covering them during the day with newspaper, which should be removed in the late afternoon.

It is possible to stand the boxes above one another for the first fourteen days. This saves space, watering and shading. It is a dangerous method, however, where there are crickets, wood lice or mice, as these are very partial to *nanus* seeds.

Potting. Firm and deepish potting is essential for *plumosus nanus*. The pots should not be too full as the plants need a good deal of water when well rooted.

Most growers pot one plant up per small 60, but it is possible to put two plants into a large 60. The former method is preferable, but the latter scheme will do quite well if there is lack of space, for the plants may be separated carefully when it is time to plant them out.

After potting, the plants should be watered well and stood on a well ashed bench or border. At this time the houses should be shaded, for during June, when this work is usually done, the sun is rather too bright for them.

There is no reason at all why they should not be stood "pot thick," and if necessary they may be ready for bedding out at the beginning of September. On the other hand, they are generally kept on in the houses until the following February. Potting up is often done in batches and it may be that one batch will be ready in September while other batches will not be fit for planting out until later.

Watering and Damping. When the plants are in pots, they should be watered every day and a sharp look-out should be kept for red spider. To keep down this pest and keep the fronds fresh, overhead damping should be done first thing in the morning.

Temperature and Ventilation. At this time the temperature in the houses should be from 60° to 65° F. The rules for

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firing, etc., will be as advised for the general growing of the crop. Little ventilation is necessary, as the houses are shaded.

Pests: Red Spider. This may be found at all stages of the plant's growth, right from the time the seedlings are first through. The fronds take on a typical grey appearance and eventually turn yellow, then brown and finally drop off. The red spider increases and spreads rapidly, not only on individual plants but from plant to plant. The greatest increase takes place in a dry atmosphere and in excessive heat.

Regular sprayings and damping overhead are necessary from the earliest times. The woodwork of the house, the pillars, walls, etc., all need damping also in an attempt to prevent this pest from breeding. A nicotine spray has proved effective, the formula used being 1 oz. of 95—98 per cent. nicotine to 30 gallons of water. Refined white petroleum oils have been used with success, but there seems to be a danger that the plants grow "hard" in consequence. White oiling often means the loss of a week or a fortnight's cut.

Aphides. Greenfly will attack plants from the time they first appear. Fumigation with tobacco shreds is usually advised, though the nicotine spray recommended for red spider will control aphides also.

Caterpillars. The green caterpillars of the Yellow Underwing moth are often a serious pest as they will grow to over 1 in. long and are difficult to find.

Hand picking is often practised after damping, when they are more easily seen, because after syringing they come to the top. A mixture of equal parts of Brown Treacle and Beer should be placed in jam jars and be hung in the house. This attracts and traps the moths.

Thrips. These damage the plants and cause the little pinners to go brown and die. Whole fronds may be disfigured in this way. Thrips definitely do not thrive in a damp atmosphere and regular dampings seem to discourage them. The nicotine sprayings as advised for red spider may be applied.

Acknowledgments.—During the last five years the writer has been on the staff of the Swanley Horticultural College, and has had the opportunity of studying the growing of *Asparagus plumosus nanus* in the Swanley district, which is famous for this crop. He is particularly indebted to his friend Mr. A. W. Farnfield, who has always welcomed him at his nursery, has placed his knowledge and wide experience at his disposal, and has very kindly read the proof of this article.

PICTURE-FILMS AS AN AID IN AGRICULTURAL EDUCATION

JOHN A. CASEBY,
Ministry of Agriculture.

THE most difficult problem that has to be faced by members of County Agricultural staffs when arranging the winter programme of evening lectures, classes and demonstrations, is that of securing support by the local people. The most forceful and enthusiastic lecturer is disheartened when he arrives at an isolated village to find only 5 or 6 members of an audience awaiting him. Even gifted lecturers specially equipped to evoke interest, are not always able to secure good audiences, because of the average man's inability to concentrate for nearly an hour at a stretch. Some lecturers make use of charts, specimens, models, etc., and although this method may be commended and arouses some interest, other steps must be taken in an endeavour to reach people who are engaged in rural pursuits.

About two years ago it was decided to try the visual form of instruction. The initial results were so gratifying that the average attendance at meetings was trebled, and at many meetings there was standing room only for late comers. Attendances of 150 at very small villages to 350 at larger centres not only make the lecturer enthusiastic, but as enthusiasm is infectious the audiences are responsive and the meetings go with a swing. The method adopted was to produce interesting series of film-slides on poultry husbandry and note how they were received. The results encouraged the further development of the idea, and the list so far comprises nearly 1,000 pictures and captions (descriptive writing) on the following subjects:—

Poultry husbandry	..	..	..	2 films
Breeds of poultry	..	..	..	1 film
Our breakfast bacon	..	..	..	2 films
The story of the honey bees	..	..	..	1 film
British breeds of cattle	..	..	..	1 ..
The milch goat	..	..	..	1 ..
Rabbits for fur and wool	..	..	..	1 ..
The National Mark	..	..	..	1 ..

Ten films varying in length from 65 to 158 pictures enable a lecturer to arrange an interesting and educative evening's programme with very little trouble. Little or no preparation

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is required in working out notes for the lectures, because, apart from the preliminary remarks, there is little to do except to elaborate any interesting features as they pass on the screen.

The apparatus required is a V.I.S. film projector, tripod stand, silver screen, and a resistance. Electric power may be used in one of three ways: (1) from the available electric supply by using the resistance so that only 12 volts pass to the lamp; (2) from a 12-volt portable accumulator; or (3) by plugging in to the small socket on the dash-board of a motor car. The amount of current used is equal to the side and tail lamps of the motor car, and the journey home after the meeting enables the battery to be brought up to normal.

Coloured Films. The idea of using coloured films occurred when the series of film slides on breeds of poultry was being compiled. Examples in mind are the beautiful colouring of a Brown Leghorn cock or a Lady Amherst cock pheasant, or even the background to a picture of any fowl, duck or turkey. Hand painting was tried by a processing firm in London and the results were true to life. Colours, however, are only practical with certain subjects. Pictures illustrating the culture of flowers would not be worth while unless colours were used. Ordinary films cost 2d. per picture and caption and 1d. for duplicate or spare copies; coloured films cost 3d. extra per picture.

Not only has this method of imparting instruction proved a decided success but the films are now used in New Zealand, Malta, Scotland, England, Wales and the Irish Free State.

Composition of the Films. The poultry husbandry series in 2 parts comprises typical specimens of standard bred poultry, incubation (natural and artificial), mammoth incubators; methods of brooding and housing; intensive, extensive, and backyard poultry keeping; fold units, slatted floors, hen batteries; diseases and pests; and marketing under the National Mark, both eggs and table poultry.

The pig film shows a boar and sow of each breed, crosses for bacon and pork production, breeding, farrowing, rearing, housing, ringing, anatomy, the administering of medicines, fattening, killing, curing bacon and marketing.

The bee film covers anatomy of the bee, hives, swarms, supering, honey extraction, marketing, and diseases.



PICTURE-FILMS IN AGRICULTURAL EDUCATION

The film on breeds of British cattle includes a description of the various breeds, followed by a picture of a prize-winning bull and cow, herds of cattle, anatomy, dentition, and marketing.

The production of the films has been made possible by the valued co-operation of "The Farmer and Stockbreeder," "The Feathered World," "Fur and Feather," The British Goat Society and the Ministry of Agriculture. Without the loan of a large amount of material (photographs and charts) the production of the series of film-slides would only have been possible at considerable expense. The result has been that the films have been produced without a penny from the public purse.

Inquiries have been received for the hire of certain films, but it has been considered best not to hire films because some of them, after loan, have been returned with scratches, and as the cost is only 2d. per picture or 1½d. when a duplicate is also purchased, they are cheap enough to purchase outright. For example, the film "The Story of our Breakfast Bacon: Pig Breeding from A to Z," includes 184 pictures and captions, and at 2d. per picture costs £1 10s. 8d. and 15s. 4d. for a duplicate. "British Breeds of Cattle" costs 16s. 8d. for 100 pictures and 8s. 4d. for a duplicate; "The Honey Bees" 18s. 8d., and so on according to the number of pictures. Apart from the value of the film slides for imparting information at Farm Institutes, and for lectures at village meetings, the fact that the films are having a wide distribution outside Great Britain should provide useful publicity for pedigree livestock from this country, whether it be an Aberdeen Angus bull, a Large White boar or a White Leghorn cockerel.

It is contemplated having a series on "Breeds of British Livestock," compiled with titles and captions in foreign languages, such as Spanish and Portuguese, available for distribution abroad. The costs of production, translations, and distribution would not amount to £50 for about 25 copies.

Finally, the total cost: a projector with battery £9 5s., tripod £1 4s., screen from 10s. to 20s. according to type and quality, spare lamps 5s. 6d. each, resistance £2 15s. Total £13 19s. and, of course, any film-slides desired at 2d. per picture and 1d. for reserves. Any other information may be obtained from the writer.

MARKETING NOTES

Milk Marketing Scheme. Pool prices and rates of producer-retailers' contributions for June, 1937, are given below, with comparative figures for May, 1937, and June, 1936. In each month the wholesale liquid milk price was 1s. per gallon.

	<i>Pool Prices</i>			<i>Producer-Retailers' Contributions</i>		
	<i>June</i> 1937 <i>d.</i>	<i>May</i> 1937 <i>d.</i>	<i>June</i> 1936 <i>d.</i>	<i>June</i> 1937 <i>d.</i>	<i>May</i> 1937 <i>d.</i>	<i>June</i> 1936 <i>d.</i>
Northern	9½	9½	9	2 ½	2 ½	2 ½
North-Western	9½	9½	9	2 ½	2 ½	2 ½
Eastern	9½	9½	9½	1 ½	2 ½	2 ½
East Midland	9½	9½	9	2 ½	2 ½	2 ½
West Midland	9	9	8½	2 ½	2 ½	2 ½
North Wales	9	9	8½	2 ½	2 ½	2 ½
South Wales	9½	9½	9	2 ½	2 ½	2 ½
Southern	9½	9½	9½	1 ½	2	2 ½
Mid-Western	9	9	8½	2 ½	2 ½	2 ½
Far-Western	9	9	8½	2 ½	2 ½	2 ½
South-Eastern	10	10	9½	1 ½	1 ½	2 ½
Unweighted Average	9·32	9 30	9·05	2·26	2·34	2·59

These prices are exclusive of any premiums for special services and level deliveries, and also of the Accredited producers' premium of 1d. per gal.

The accredited premium was paid on 33,415,442 gal., and the sum required for the payment of the premium was equivalent to a levy of 0.338d. per gal., on pool sales.

The inter-regional compensation levy was fixed at 1d. per gal., compared with 1½d. per gal. in June, 1936.

Sales on wholesale contracts were as follows:—

	<i>June, 1937</i> <i>(estimated)</i>	<i>June, 1936</i>
	<i>Gallons</i>	<i>Gallons</i>
Liquid	48,932,786	46,672,156
Manufacturing	37,920,564	40,891,822
	86,853,350	87,563,978
Percentage liquid sales	56·34	53·30
Percentage manufacturing sales	43·66	46·70

The average realization price of manufacturing milk during June was 5·40d. per gal. compared with 4·97d. per

MARKETING NOTES

gal. for June, 1936. The quantity of milk manufactured into cheese on farms was 3,107,391 gal. compared with 2,946,687 gal. in the previous month and 2,700,394 gal. in June, 1936.

Direction of Milk Supplies. The Milk Marketing Board announce that, after consulting the Central Milk Distributive Committee, they have prepared a plan for allocating milk supplies on wholesale contracts, which is designed to ensure that adequate supplies will be available at all times for the liquid market, and that the higher price-category manufacturing markets will have prior consideration over those carrying lower prices. Producers' supplies will be directed without undue disturbance, and one of the aims of the plan is to enable a call to be made on manufacturing milk in all times of shortage of milk for the liquid market.

Milk Scheme Amendments. In accordance with the Agricultural Marketing Acts a draft of certain of the amendments to the Milk Marketing Scheme, as modified by the Minister, were laid before Parliament for approval on July 16.

Potato Marketing Scheme. *The Farmers' Marketing Supply Co., Ltd.* The Company's factory at Wisbech for the manufacture of cattle food from surplus and undersized potatoes unsuitable for human consumption was closed down for the season on June 21, having been open since September 15, 1936. During the period of its operation, approximately 5,000 tons of potatoes have been processed.

Sale of "Seconds." Permits for the sale of "Seconds"—potatoes that pass through a riddle of $1\frac{1}{8}$ in. but stand on a riddle of $1\frac{1}{4}$ in.—up to a total of 27,046 tons have been issued during the course of the season.

Milk Acts, 1934 and 1936: Manufacturing Milk. The following tables give details of the advances made in respect of manufacturing milk for the first three years of the operation of these Acts. The figures include an allowance for claims not yet received in respect of milk manufactured up to and including March, 1937.

MARKETING NOTES

GALLONAGES OF MANUFACTURING MILK AND ADVANCES MADE IN RESPECT OF THE DIFFERENT PARTS OF THE UNITED KINGDOM

Year (April-March)	England and Wales	Scotland	Great Britain	Northern Ireland	United Kingdom
<i>Gallonage (million gallons)</i>					
1934-35 ..	172.0	26.2	198.2	18.3	216.5
1935-36 ..	225.7	27.8	253.5	23.9	277.4
1936-37 ..	183.0	20.4	203.4	25.2	228.6
TOTALS ..	580.7	74.4	655.1	67.4	722.5
<i>Advances (thousand £)</i>					
1934-35 ..	1,115	163	1,278	164	1,442
1935-36 ..	1,067	123	1,190	133	1,323
1936-37 ..	297	32	329	94	423
TOTALS ..	2,479	318	2,797	391	3,188

ADVANCES IN RESPECT OF EACH PRODUCT MANUFACTURED (England and Wales)

Year (April to March)	Butter		Cheese		Milk Powder		Condensed Milk for Export		Tinned Cream		All Products	
	Gal '000	£ '000	Gal. '000	£ '000	Gal '000	£ '000	Gal '000	£ '000	Gal. '000	£ '000	Gal. '000	£ '000
1934-35 ..	57,983	395	94,782	624	9,376	36	7,113	46	2,752	11	271,978	1,115
1935-36 ..	99,083	486	104,106	490	12,500	43	9,983	48	—	—	225,674	1,067
1936-37 ..	93,588	158	73,993	116	6,826	9	8,674	14	—	—	183,082	297
TOTALS ..	250,654	1,039	272,881	1,233	28,702	88	25,770	108	2,752	11	580,734	2,429

TOTAL QUANTITIES OF MANUFACTURING MILK, QUALITIES AND PER- CENTAGES OF MILK ON WHICH ADVANCES HAVE BEEN PAID, AND AVERAGE RATES OF ADVANCE PER GALLON (England and Wales)

Year (April-March)	Total of manufactur- ing milk	Total on which ad- vances have been or will be paid	Percentage of total on which ad- vances paid	Average rate per gallon on gallonage subsidized	Average rate per gallon on all manu- facturing milk
	'000 gal	'000 gal	%	d	d
1934-35 ..	253,006	171,978	67.95	1.56	1.06
1935-36 ..	338,889	225,674	66.59	1.13	0.76
1936-37 ..	347,676	183,082	52.66	0.39	0.21
TOTALS ..	939,561	580,734	61.80	1.02	0.63

MARKETING NOTES

Milk-in-Schools Scheme. The following figures show the gallonage of milk consumed in the first seven months of the third year of the scheme, compared with the corresponding period in the first and second years. The figures for the third period will be slightly increased when further returns are received.

	<i>Gallons</i>	<i>Exchequer Contribution</i>
October, 1934, to April, 1935 ..	14,754,077	£320,070
October, 1935, to April, 1936 ..	13,592,560	£308,154
October, 1936, to April, 1937 ..	13,675,789	£309,836

Cheese-Milk Price. For the purpose of payments under the Milk Acts (whether by the Exchequer to Milk Marketing Boards or by Boards to the Exchequer) in respect of milk used for manufacture, the cheese-milk price has been certified by the Minister and the Secretary of State for Scotland to be 6·46 pence per lb. for the month of July, 1937.

Wheat Act, 1932. Sales of Home-Grown Wheat, Cereal Year, 1936-37. Certificates lodged with the Wheat Commission by registered growers during the period August 1, 1936, to July 9, 1937, cover sales of 22,100,155½ cwt. of millable wheat as compared with 32,544,272½ cwt. in the corresponding period (to July 10) in the last cereal year.

Purchase of Stocks of Home-Grown Wheat. Section 1 (3) of the Wheat Act, 1932, empowers the Minister by order to require the Flour Millers' Corporation to purchase unsold stocks of home-grown millable wheat up to a certain maximum if the Wheat Commission in the month of June in any year make a representation to the Minister that it is expedient that this should be done. The Wheat Commission have resolved that no such representation should be made to the Minister in respect of the cereal year 1936-37.

Sugar Industry (Reorganization) Act, 1936. Reports and Accounts of British Sugar Corporation, Ltd. The published results of the first year's working of the Corporation show a trading profit for the 12 months ended March 31, 1937, of £1,245,143. After providing for all charges and writing off the whole of the preliminary expenses and the discount on the

MARKETING NOTES

Debenture stock, and after making various appropriations, there remained a balance of £231,570. In recommending a dividend of 4 per cent. less tax, which will absorb £150,000 and leave a balance to be carried forward of £81,570, the directors have advised shareholders that the high profit attained in the first year is due to exceptional circumstances and that it would not be prudent to assume that so good a result is likely to be repeated in future years.

Livestock Industry Act, 1937. The amendments made to the Livestock Industry Bill in the House of Lords were considered by the House of Commons on July 13, and agreed to. The Bill received the Royal Assent on July 20.

Cattle Fund. The following table gives particulars of payments made under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936.

Period	Payments	Animals	Average Payment per Animal
	£		£ s. d.
April to June, 1935	937,280	394,958	2 7 6
April to June, 1936	985,615	422,044	2 6 8
April to June, 1937	971,545	414,497	2 6 11
Sept. 1, 1934* to June 30, 1937	10,851,598	4,582,340	2 7 5

* Commencement of subsidy payments.

National Mark Cheese Schemes. As the result of a recommendation made by the National Mark Cheese Trade Committee at its meeting on June 10, 1937, the following amendments have been made to the conditions to be observed by authorized packers in the National Mark Cream Cheese Scheme. The requirement that the National Mark shall be applied only to cheese of certain specified weights has been withdrawn.

The requirement that each cheese shall be separately wrapped in metal foil of approved quality or a muslin bandage has been modified to permit the use for this purpose of any material that may be approved by the Minister on the advice of the National Mark Cheese Trade Committee.

MARKETING NOTES

Particulars of the total output of cheese under each of the schemes for the quarter ended March 31, 1937, are as follows :—

<i>Type of Cheese</i>	<i>Number and Weight of Cheese Graded</i>	
	<i>No.</i>	<i>Weight Cwt.</i>
Cheshire :		
(a) Farm made	8,584	3,888
(b) Creamery made	6,894	2,503
Caerphilly	84,061	4,473
Cheddar	2,484	1,083½
Lancashire	10,055	3,315
Wensleydale	2,517	190
Leicester	390	114½
Stilton :		
(a) Blue	1,907	240
(b) White	3,983	594
Cream	7,778	14½
Derby	70	20½

National Mark Creamery Butter Scheme. It is, at present, a requirement under this Scheme that wrappers containing National Mark creamery butter shall bear an indication of the date of packing either in code or in such manner as may be approved by the Minister. The National Mark Creamery Butter Trade Committee—the Committee that advises the Ministry on the general administration of the scheme—recently came to the conclusion that it would be of advantage for this purpose if authorized packers were to use a common code. The Committee recommended, accordingly, that it should be made a condition of authorization under the Scheme, as regards any future entrant, that the packer concerned should use the code dating system drawn up by the Ministry, and that any packer already operating under the Scheme who uses a private code should be urged to change over to the Ministry's code dating system. Steps are being taken to give effect to this recommendation.

Fatstock : Carcass Sale by Grade and Deadweight. During the three months ended June 30, 1937, 2,183 cattle, 3,173 sheep and 2,020 pigs were dealt with under the Grade and Deadweight Scheme.

In conjunction with the Welsh Agricultural Organization Society arrangements were completed in June to enable producers in Mid- and South Wales to co-operate in forwarding bulk consignments of lambs and sheep under the scheme to Birmingham and Liverpool grading centres. The procedure is similar to that adopted during the 1935 and 1936 seasons,

MARKETING NOTES

and a number of group agents have again been appointed to deal with consignments in each district.

Marketing Demonstrations. Particulars of exhibits and demonstrations to be staged by the Ministry during August are as follows:—

<i>Show</i>	<i>Demonstration</i>
Royal Lancs, Withington, Manchester .. July 29—August 2.	Egg-testing and grading, and livestock demonstrations. Dairy produce, egg and fruit exhibits.
Southport Flower, Southport August 25-27.	Cheese-making demonstration. Honey, vegetable and general National Mark produce exhibits.
Sandy August 26.	National Mark vegetables and other products.

AUGUST ON THE FARM

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Provided the weather is favourable there are no idle months on arable farms. The pressure of work in the spring and early summer in getting in the crop and attending to after-cultivations is no sooner over than the securing of the harvest becomes a matter of importance. Favourable weather conditions not only reduce the amount of labour involved but also greatly affect the quality. Even in such circumstances harvesting is a matter that requires attention and skill. Faulty management may result in inferior samples and reduced values. This is especially so with barley. In dry seasons a steely sample, which commands a lower price, may often be avoided by careful harvesting. Experienced barley growers know how to make use of any favourable opportunity to improve condition and mellowness. Mowing and leaving the crop open on the ground, careful turning by hand, and turning the sheaves in the stook—all operations that entail extra work—should not be considered too much trouble if likely to produce a better malting sample.

The present month is the favourite holiday season for most, but is one of the busiest on arable farms.

Reference has already been made to the difficulty of getting in root seeds owing to unfavourable weather conditions earlier in the season. Continued wet weather in many districts has made the after cleaning of the crop very difficult, and in these areas a spell of dry hot weather would be a great boon. In Britain we are accustomed to changeable weather, but 1937 seems rather abnormal in that districts have varied greatly in the type of weather they have experienced. The writer does not remember meeting with so many varied reports from agriculturists in different parts of the country. From some places there have been complaints of rather too little rain while from others reports have been the reverse. In the north of England on many farms there is an abundance of grass but the price of stores is such that there is little inducement to

AUGUST ON THE FARM

purchase stock to consume it. The seasonal variation in productivity of much of our grass land is such that good grazing management is exceedingly difficult. It is a striking fact that the variation from season to season on our best fattening pastures is less than on those of a somewhat inferior type. No doubt this factor makes possible better grazing of the good pastures, and this contributes to their productivity.

Preparing for Next Year. Although we are by no means finished with the present season's crops it is not too early to give consideration to the cropping for next year. On many farms this is not difficult, as an ordered rotation is followed, although this is by no means as general as it used to be. Rotations have been much modified during recent years and farmers now depart from the regular course much more frequently.

The introduction of new crops, the comparative ease with which land can be put down to grass, and fluctuations in values of different crops, are some of the factors responsible for this elasticity in cropping.

Where an opportunity presents itself after corn has been cleared, a start can frequently be made with the preparation for next year's crop, when harvesting operations are held up. In a favourable autumn much can be done to clean stubbles, and, by suitable cultural operations, not only can growing weeds be destroyed, but, by producing a good surface tilth, weed seeds are encouraged to germinate and can then be destroyed. As long as they remain in the soil they are a source of potential trouble. Farmers in the drier arable areas are alive to the value of autumn cleaning. It is good to see implements going as soon as a field is cleared, but it is often an advantage for cultivation to be carried out between the rows of stooks while these are still in the field.

The north of England provides little opportunity for cleaning of this description. The season is later, and if dry weather prevails the farmer has learned by experience that it is often wise to get straight on with ploughing under favourable conditions. The advantage of getting land ploughed when dry in the autumn is too well appreciated to risk delay for other matters.

Breeding for Fat Lambs. Rams will be turned out during the month on farms where January lambs are wanted. The

AUGUST ON 'THE' FARM

choice of the ram for early lamb production is an important matter. Breed will depend on locality, type of farm and market. It is important, however, that the progeny should have the capacity to fatten early. Breeders who purchase rams often remark that they get better fat lambs by using a lamb rather than a shearling. This is quite understandable. They would be unlikely to purchase a ram for that purpose that did not show plenty of flesh. The well conditioned ram lamb has produced flesh while young and would be likely to hand on this property to his offspring. As regards the shearling, however well fleshed he may be at eighteen months old, he may have matured slowly and have shown poor fleshing properties as a lamb. When choosing a ram for fat lambs it is desirable to see the animal when quite young, at about the age his offspring would be marketed. There is much difference in the relative amount of flesh carried by ram lambs during their growing period. In flocks where ram lambs are being prepared for sale no effort is spared to have animals in condition for the sales.

The need for careful selection of breeding ewes within the flock, and the popularity of prolific breeds or crosses, were referred to in the July notes. At Cockle Park for the past two seasons Romney Marsh ewes have been run along with Half-bred (Border Leicester X Cheviot) ewes. While the introduction of Romney Marsh ewes to Cockle Park was for reasons other than to compare prolificacy, the results in this connexion are interesting—the lambing percentages of the Romney Marsh and Half-bred being 122 and 160 respectively. It is noted that the Half-bred milks better, and the live-weight increase, especially with twin lambs, is better than with the Romney. On the other hand, the Half-bred ewes if not on good pasture lose a little weight, while the Romney shows an increase under the same conditions.

Cattle. Large numbers of grass-fattened cattle have now been marketed from the grazing districts of the north of England. Returns based on the purchase prices of last summer and autumn have been satisfactory. Late spring-bought cattle, however, are likely to leave little margin and may even prove a source of loss if present prices do not hold. The replacement of cattle that have already been sold, which is a customary practice on many farms in the north, is an expensive item, for store prices remain high.

AUGUST ON THE FARM

The development of the system of fattening cattle on grass is a striking feature of the farming in north-east Northumberland. Much Boulder Clay land of good type, which originally grew arable crops, is now laid down to productive permanent grass. Large areas fatten one bullock and in addition graze a Half-bred ewe and her lambs per acre. Nearly 4 cwt. of live-weight increase per acre are obtained from cattle grazing apart from sheep. The art of grazing has been developed to a high standard on these feeding farms. Practical graziers have evolved a system that works very well indeed, and there is no doubt this high output, which is obtained from the best pastures in Leicestershire and Northamptonshire as well as in Northumberland, is due, in no small measure, to grazing management. Most of the cattle fed in Northumberland are Angus cross Irish heifers. The quality and finish of the animals marketed from the end of June to October at Belford and Alnwick cannot be excelled in any market. The manurial treatment and type of grazing animal play their part in successful management, but efficient control of the grazing is an all-important factor.

Milk Yields. During the month there is frequently a falling off in yield from dairy herds. Several circumstances may account for this. Close attention to the yield of individual cows may often throw light on the question. Frequently, reduced yield may be due to a falling off in the quantity and quality of the pasturage. Where this is so supplementary feeding may do much to check the fall. Weather conditions, however, also affect yield. Cooler nights and annoyance by flies during the day may also be responsible for trouble in this respect. It is noticeable that some animals suffer much more than others from irritation by flies and this is reflected in milk yield. Housing in cool cowsheds during the heat of the day is sometimes advantageous. Blue colouring above the stall seems to have an inhibitory effect on the activity of flies. Damping of the floors helps towards coolness in the cowshed, and also has the effect of keeping down dust. An abundant supply of fresh clean water should be provided for dairy stock at all times, but it is particularly important during warm weather. Muddy ponds are unsuitable as the animals cannot keep clean, and this adds to the risks of mastitis and other troubles.

AUGUST ON THE FARM

Labour. Competitions in connexion with singling and other cultural operations on the farm deserve the fullest possible encouragement. Although mechanization has, in some directions, reduced the need for certain types of hand labour, there remains much that can only be done by this type of labour, and, one should add, skilled hand labour.

If production is to be increased or even maintained, an adequate supply of efficient labour is essential. From many parts of the country there are complaints of a shortage of workers, and in not a few instances farmers also complain of the indifferent quality of the work done.

One very important factor affecting efficiency is the interest a man has in his work. A marked example of increased interest begetting efficiency is evidenced by the influence of milk recording, bacterial counts and the like, not only upon the dairy farmer but also upon the best type of worker.

Agricultural shows and visits to experimental farms may all serve a useful purpose in increasing the interest of the men in their daily work on the farm. One of the most interesting and interested parties that ever visited Cockle Park was made up of shepherds and cattle-men, many of whom were required to make a very early start in order to spend a full day on the farm. A pleasing feature of the meeting of Agricultural Discussion Societies during the winter months is the increasing attendance of farm workers. It is greatly to be desired that this should be further encouraged throughout the country.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended July 7				
	Bristol	Hull	L'pool	London	Costs per Unit [†]
Nitrate of Soda (N. 15½%) ..	£ 8.	£ 8.	£ 8.	£ 8.	s. d.
" " Granulated (N. 16%) ..	7 12c	7 12c	7 12c	7 12c	9 10
Nitro-Chalk (N. 15½%) ..	7 12c	7 12c	7 12c	7 12c	9 6
Sulphate of Ammonia:—	7 5c	7 5c	7 5c	7 5c	9 4
Neutral (N. 20·6%) ..	7 5c	7 5c	7 5c	7 5c	7 0
Calcium Cyanamide (N. 20·6%)	7 5d	7 5d	7 5d	7 5d	7 0
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 0	4 17	4 15	4 17	3 3
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%)	8 3	8 1	7 17	8 1	3 3
Sulphate " (Pot. 48%)	9 15	9 13	9 9	9 13	4 0
Basic Slag (P.A. 15½%) ..	2 10b	2 2b	—	2 7b	3 0
" " (P.A. 14%) ..	2 5b	1 17b	1 17b	2 3b	3 1
Grd. Rock Phosphate (P.A. 26-27½%) ..	2 12a	—	2 10a	2 5a	1 8
Superphosphate (S.P.A. 16%)	3 4	—	3 3e	3 0f	3 9
" " (S.P.A. 13½%)	3 1	2 17	2 19e	2 16f	4 1
Bone Meal (N. 3½%, P.A. 20½%)	—	6 10	7 5g	7 0	—
Steamed Bone Flour (N. ½%, P.A. 27½-29½%) ..	5 5h	5 10	5 0g	5 0	—

Abbreviations: N. = Nitrogen:
S.P.A. = Soluble Phosphoric Acid:

P.A. = Phosphoric Acid:
Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 4-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 4 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra, for lots of 10 cwt. and under 1 ton, 15s. extra, and for lots of less than 10 cwt. but not less than 2 cwt., 20s. extra.

e Prices shown are f.o.r. Widnes.

f Prices shown are f.o.r. northern rails; southern rails 1s. 3d. extra.

g Prices shown are f.o.r. Appley Bridge.

h Price shown is f.o.r. Newport, Mon.

† These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent. nitrogen, contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge).

NOTES ON FEEDING

CHARLES CROWTHER, M.A., PH.D.,
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Poultry Experiments in Northern Ireland. Since the establishment, by the Ministry of Agriculture for Northern Ireland, of the Agricultural Research Institute at Hillsborough, practical feeding investigations with poultry have been continuously in progress, and have yielded results that have attracted widespread attention. These results have been embodied in a series of reports, but are now available in conveniently summarized form in the recently issued Eleventh General Report of the Ministry, which relates more specifically to the period 1931-34.

Some of the more interesting conclusions, directly applicable on the farm, are summarized below.

Growth of Chickens. The addition of *common salt* (sodium chloride) to a ration of cereals improved the growth rate and condition of the chicks, even when they received separated milk to drink *ad lib*. As little as one-quarter per cent. of common salt in the ration proved to be adequate, no further improvement being recorded by increasing the amount. The deficiency remedied by the salt is primarily one of *sodium* rather than of chlorine.

Studies of the level of protein supply that is desirable in rearing rations gave somewhat contradictory results, but furnished no support to the findings of most American workers, which fix the optimum protein content as high as 20 per cent. It may be noted in passing that no pathological effects were observed when the protein content of the ration was increased to as much as 28.3 per cent. (equivalent to 49.5 per cent. of soya meal in the ration).

In the course of the Hillsborough experiments there has developed a form of leg weakness that was not curable by cod-liver oil, but could be cured by the use of separated milk.

NOTES ON FEEDING

Occasionally it could be alleviated by large doses of bran or by giving sulphur, but magnesium sulphate had no effect. The incidence of the leg weakness was more acute when soya meal or meat meal was included in the mash than when fish meal was used. It did not occur when dried milk or dried yeast was included in the mash. Egg white and dried whey were similarly effective in preventing its occurrence. The use of dried milk and dried yeast also produced more rapid and more even growth in the birds.

Laying Experiments. In studies of the mineral requirements of laying pullets it was found that when $\frac{1}{2}$ per cent. of common salt was included in the mash, and oyster shell or limestone grit was supplied *ad lib.* as a source of lime, no other mineral supplement was necessary, even when the other constituents of the mash were entirely of vegetable origin. Higher allowances of salt did not give any further increase of production.

The use of artificial illumination in winter had no effect on production, but it is noted that in this particular test the level of production in the control pens was of a very high order.

Excellent egg production was obtained from the use of a laying mash composed of 2 parts by weight of cooked potatoes 1 part of maize meal and 1 part of coarsely-ground oats, when it was supplemented with separated milk or with common salt and steamed bone flour. The amount of food consumed, however, was abnormally high. If the milk (or salt) were omitted production was poor.

The effects of supplements of fish meal, high grade meat meal, extracted soya meal, and a mixture of meat and soya meals were compared and showed no significant differences.

One series in the Irish tests that has attracted widespread interest is that in which the effect of omitting the usual protein supplement from the laying mash has been studied. A laying mash consisting entirely of cereal meals supplemented only with common salt has been fed to nine groups of birds, and in each instance a high level of production was obtained. Comparable groups receiving the same mash supplemented by protein concentrates did not give any better yields except in 1933, when in each of four experiments the groups receiving protein gave a slightly higher production than that from the unsupplemented group. The difference in each experiment considered separately was small, and probably not "significant."

NOTES ON FEEDING

Access to grass runs did not appear to affect the number or size of eggs laid, either with birds receiving protein supplements or with those on the unsupplemented mash. Absence of grass on the runs had, however, a marked lowering effect on the fertility and hatchability of the eggs in each group.

Reference is also made in the report to studies on the storage of calcium and phosphorus in the body by pullets before laying and during the early stages of laying. One conclusion to be drawn from these experiments is that part of the benefit derived from the addition of common salt to a ration of cereal meals plus soya meal is due to the favourable effect of the salt upon the retention of calcium in the body.

There seems to be a connexion between shell formation and loss of phosphorus from the body, at least on certain rations, but the experiments as a whole suggest strongly that laying birds receiving correct cereal plus soya meal plus salt rations, together with lime, do not require any extra source of phosphorus.

Later Experiments. This brief review of the Hillsborough experiments may be rounded off by reference to the nutritional aspects of more recent experimental work at the same centre reported in the current issue of the *Journal of the Ministry of Agriculture for Northern Ireland* (Vol. V, 1937).

Differences in systems of feeding and management such as are found on good commercial poultry farms did not affect the quality of the eggs produced to any appreciable degree. The data raise the possibility that exercise may have a slightly beneficial influence, but if so it was certainly not large enough to affect the commercial value of the eggs.

The hens' rate of production does not seem to have any effect on the quality of the eggs, but individual hens differed considerably in this respect. No differences could be observed between eggs from White Wyandottes, Rhode Island Reds and White Leghorns, as regards either quality of eggs laid or keeping qualities.

In an investigation on the shell strength of eggs, in which more than 5,000 eggs were tested, it was found that the rations fed to the hens, and the systems of management of which examples were investigated, were not the causes of any noteworthy variations in shell-strength. Similarly no breed factor of importance could be detected, but in each breed there was a tendency for shell strength to fall slightly during the first half of the year and to rise again during the second half. The

NOTES ON FEEDING

individuality of the bird seemed to be the most potent factor in determining shell strength.

In another experiment reported a comparison was made of the ordinary method of feeding (mash *ad lib.* along with a restricted grain allowance) with the alternative method of rationing the mash and giving grain *ad lib.* The daily allowance of mash to the second group was fixed at 1 oz. given once daily.

The average daily consumption of mash and grain, and the average egg production in each group are shown below:—

AVERAGE FOOD CONSUMPTION

	<i>Grain Rationed</i>			<i>Mash Rationed</i>		
	<i>Mash</i>	<i>Grain</i>	<i>Total</i>	<i>Mash</i>	<i>Grain</i>	<i>Total</i>
	<i>ad lib</i>	<i>(rationed)</i>		<i>(rationed)</i>	<i>ad lib.</i>	
	oz	oz.	oz	oz.	oz.	oz.
Oct. 1934—Sept. 1935	2.5	2.0	4.5	0.9	3.2	4.1
Oct. 1935—Mar. 1936	2.7	2.0	4.7	0.8	3.8	4.6

AVERAGE NUMBER OF EGGS PER BIRD

	<i>Mash ad lib</i>			<i>Grain ad lib</i>		
	<i>Grain Rationed</i>			<i>Mash Rationed</i>		
Oct 1934—Feb 1935	..	.	67	..	.	86
Mar. 1935—Sept. 1935	.	..	131	..	..	115
Oct. 1934—Sept. 1935	198	..	..	201
Oct. 1935—Mar. 1936	..	.	53	..	..	64

It will be seen that, while a satisfactory level of egg production was maintained in both groups throughout the experiment, the production in the first winter was considerably higher in the group receiving grain *ad lib.* than in the other group that received the more orthodox type of feeding. On the other hand, during the following spring and summer the relative positions were reversed, so that for the whole period of 12 months the total production was practically the same in each group. During the second winter, as in the first, the grain *ad lib.* group gave the better production.

There was no difference between the groups at any stage in respect of the average size of eggs laid, which was 25.1 oz. per dozen over the whole period. Similarly there was little to choose between the groups in respect of body weight or condition.

The superior winter production from the grain *ad lib.* group gave it an advantage of 2s. 7d. per head in value of eggs produced in the whole 18-months period of the test, representing an extra profit (over cost of food) of 3s. 10d. per head when

NOTES ON FEEDING

the lower cost of the grain *ad lib.* feeding is brought into account.

Attention is drawn in the report on this experiment to the significance of the latter system to the smaller poultry-keeper for reducing feeding costs, since supplies of grain can be purchased in quantity and stored for periods that would be impossible with meals. It also enables the farmer to utilize home-grown grain to a much greater extent than the alternative system. It is emphasized, however, that the experimental results require to be confirmed before the general adoption of the system can be recommended.

Another experiment reported in the same place deals with the possibility of replacing Sussex ground oats in laying mash by cheaper substitutes such as bran, maize, and coarsely-ground oats. In each instance the substitution caused increased food consumption, but gave a higher rate of egg production, lower feeding costs, and increased profit over cost of food. The use of maize meal also produced a greater gain in bodyweight.

Pig Feeding Experiments. From Hillsborough comes also a report on pig feeding experiments in which comparisons were made between unrestricted dry feeding and restricted wet feeding, and also between ground wheat and pollard. Each comparison was repeated five times, but the duration of feeding in the individual trials varied from 6-16 weeks. The average initial live-weights of the groups also varied in the different trials, but except for the second trial (46-51 lb.) was roughly 90-95 lb. In the first two trials the pigs were fed up to bacon weights, the average final weights per group ranging from 191 to 236 lb.; whilst in the other experiments the pigs were disposed of earlier, the group averages ranging from 141 to 184 lb.

The ration used consisted (in parts by weight) of barley meal 1, maize meal 2, flaked maize 2, pollard (or ground wheat) 3, extracted soya meal $\frac{1}{2}$. To this was added a mixture of 3 parts ground limestone and 1 part of salt at the rate of 2 lb. per cwt. of mixed meals. All the groups also received separated milk at the rate of 1 pint per head per day, and all had automatic drinking bowls in the pens.

In the dry-fed groups the food was given in automatic feeders that were always open to the pigs. In the wet-fed groups the meal was damped in buckets after each meal in preparation for the next, and the amount was regulated so that the pigs

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readily cleared up their meal in 10-15 minutes. These groups were fed three times per day, except that in the last two trials the mid-day feed on Sundays was omitted. For the purposes of the food consumption records 1 gal. of separated milk was taken to be equivalent to $1\frac{1}{2}$ lb. of meal.

Taking the trials as a whole the dry-fed groups generally showed higher live-weight increases than the comparable wet-fed groups, but consumed disproportionately more food, and therefore took, on the average, more food per pound live-weight increase. The averages taken over all groups are set out below:—

	<i>Restricted Wet Feeding</i> lb.	<i>Unrestricted Dry Feeding</i> lb.
Average live-weight gain per pig per day	1.32	1.51
Average meal taken	4.70	5.71
Average " " per 1 lb live-weight gain	3.56	3.78

When account is taken by statistical methods of the influence of the difference in meal consumption between the two groups upon the average rates of live-weight gain it is found that there was no significant difference in the efficiency of conversion of the food consumed; in other words, for a given increase in the rate of meal consumption the two methods of feeding would have given about the same increase in the rate of growth.

With any method of feeding a certain amount of waste of food is inevitable, which would be higher in the dry-fed groups than in the wet-fed groups. This accounts for some part of the extra meal used by the former.

In three of the trials the carcasses were graded, with results indicating a marked superiority of the wet-fed (restricted) pigs over the dry-fed (unrestricted) pigs. Thus in the 4th and 5th trials, in which 62 pigs were graded similarly, the wet-feeding gave 10 first-grade and 4 third-grade pigs, whereas the dry-feeding gave only 3 first grade and 17 third-grade pigs.

In the parallel experiments in which ground wheat was compared with pollard, under wet-feeding and dry-feeding conditions, no appreciable difference was found between the two feeding-stuffs either in live-weight gain or meal consumption, the average results for all groups being as summarized below:—

	<i>Pollard Ration</i> lb.	<i>Wheat Ration</i> lb.
Average live-weight gain per pig per day ..	1.42	1.41
Average meal taken	5.19	5.21
Average " " 1 lb live-weight gain	3.66	3.68

NOTES ON FEEDING

Similarly no significant difference was found in the quality grading of the carcasses.

To those who are accustomed to measure nutritive values of feeding stuffs in terms of starch equivalents it may on first thoughts appear surprising that pollard should have given as good live-weight gains as wheat, but if the total starch equivalent of each ration used in this trial be compared it will be seen that the difference is very small, and probably not measurable by group-feeding methods of experiment, unless carried out on a very large scale. The close agreement of the two average results is thus quite in accordance with expectation based upon the commonly-used methods of assessing nutritive values.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	9 12	0 8	9 4	72	2 7	1.38	9.6
Barley, British Feeding	8 15	0 8	8 7	71	2 4	1.25	6.2
" Argentine	9 0	0 8	8 12	71	2 5	1.29	6.2
" Danubian	8 10†	0 8	8 2	71	2 3	1.21	6.2
" Iraqian	8 7	0 8	7 19	71	2 3	1.21	6.2
" Persian	8 10	0 8	8 2	71	2 3	1.21	6.2
Oats, English, white ..	9 13	0 9	9 4	60	3 1	1.65	7.6
" " black and grey	9 13	0 9	9 4	60	3 1	1.65	7.6
" Scotch, white ..	10 10	0 9	10 1	60	3 4	1.79	7.6
" Canadian mixed feed	8 17	0 9	8 8	60	2 10	1.52	7.6
Maize, Argentine	6 10	0 7	6 3	78	1 7	0.85	7.6
" Gal. Fox	6 5†	0 7	5 18	78	1 6	0.80	7.6
Peas, Japanese	20 5†	0 15	19 10	69	5 8	3.04	18.1
Dari	8 15†	0 8	8 7	74	2 3	1.21	7.2
Milling Offals:—							
Bran, British	6 7	0 16	5 11	43	2 7	1.38	9.9
" broad	6 12	0 16	5 16	43	2 8	1.43	10.0
Middlings, fine, im- ported	8 2*	0 13	7 9	69	2 2	1.16	12.1
Weatings†	7 12	0 14	6 18	56	2 6	1.34	10.7
" Superfine†	8 2	0 13	7 9	69	2 2	1.16	12.1
Pollards, imported ..	7 2	0 14	6 8	50	2 7	1.38	11.0
Meal, barley	9 12	0 8	9 4	71	2 7	1.38	6.2
" " grade II	8 17	0 8	8 9	71	2 5	1.29	6.2
" maize	7 0	0 7	6 13	78	1 8	0.89	7.6
" " germ	7 5	0 11	6 14	84	1 7	0.85	10.3
" locust bean	7 15	0 5	7 10	71	2 1	1.12	3.6
" bean	8 12	0 17	7 15	66	2 4	1.25	19.7
" fish (white)	14 15	2 2	12 13	59	4 3	2.28	53.0
" Soya bean (extracted)†	9 2	1 9	7 13	64	2 5	1.29	38.3
Maize, cooked, flaked ..	7 10	0 7	7 3	84	1 8	0.89	9.2
Linseed cake—							
English, 12% oil ..	9 17	1 0	8 17	74	2 5	1.29	24.6
" 9% "	9 5	1 0	8 5	74	2 3	1.21	24.6
" 8% "	9 0	1 0	8 0	74	2 2	1.16	24.6
Cottonseed cake, English, Egyptian seed, 4½% oil	5 17	0 18	4 19	42	2 4	1.25	17.3
Cottonseed cake, Egyptian, 4½% oil ..	5 7	0 18	4 9	42	2 1	1.12	17.3
Cottonseed cake, decorticated, 7% oil ..	8 10†	1 8	7 2	68	2 1	1.12	34.7
Cottonseed meal, decorticated, 7% oil ..	8 0†	1 8	6 12	70	1 11	1.03	36.8
Coconut cake, 6% oil ..	7 7	0 18	6 9	77	1 8	0.89	16.4
Ground nut cake, decorticated, 6-7% oil	8 12‡	1 8	7 4	73	2 0	1.07	41.3

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Ground nut cake, imported decorticated, 6-7% oil	7 15	1 8	6 7	73	1 9	0.94	41.3
Palm-kernel cake, 4½-5½% oil	7 7½	0 11	6 16	73	1 10	0.98	16.9
Palm-kernel cake, meal, 4½% oil	7 17½	0 11	7 6	73	2 0	1.07	16.9
Palm-kernel cake meal, 1-2% oil	6 15	0 12	6 3	71	1 9	0.94	16.5
Feeding treacle	5 0	0 8	4 12	51	1 10	0.98	2.7
Brewers' grains, dried ale Brewers' grains, dried porter	5 15	0 11	5 4	48	2 2	1.16	12.5
Dried sugar-beet pulp ..	5 7	0 11	4 16	48	2 0	1.07	12.5

From £5 7s. 6d. to £5 15s. 0d. per ton ex-factory
(according to factory).

* At Bristol.

§ At Hull.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex-mill or store. The prices were current at the end of June, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 per ton as shown above, the cost of food value per ton is £10. Dividing this figure by 74,* the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1.43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 3d.; P₂O₅, 2s. 3d.; K₂O, 3s. 6d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6·2	8 12
Maize	78	7·6	6 10
Decorticated ground-nut cake	73	41·3	8 3
" cotton-seed cake	68	34·7	8 10

(Add ros. per ton, in each instance, for carriage.)

The cost per unit starch equivalent works out at 2·09 shillings, and per unit protein equivalent 0·77 shilling. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent	Protein equivalent	Food Value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	7 18
Oats	60	7·6	6 11
Barley	71	6·2	7 13
Potatoes	18	0·8	1 18
Swedes	7	0·7	0 15
Mangolds	7	0·4	0 15
Beans	66	19·7	7 13
Good meadow hay	37	4·6	4 1
Good oat straw	20	0·9	2 2
Good clover hay	38	7·0	4 5
Vetch and oat silage	13	1·6	1 8
Barley straw	23	0·7	2 9
Wheat straw	13	0·1	1 7
Bean straw	23	1·7	2 9

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d., post free 7d.

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The Agricultural Index Number

The general index number of prices of agricultural produce for June is 131 (base, June, 1911-13=100) or 2 points lower than for May but 15 points higher than that for June, 1936. If allowance is made for payments under the Wheat Act, 1932, and the Cattle Industry (Emergency Provisions) Act, 1934, the revised index for the month under review becomes 134. Many of the average prices of commodities used in the compilation of the index number were slightly lower in June than in May; milk, however, was unchanged while eggs were higher in price.

Monthly index numbers of prices of Agricultural Produce. (Corresponding months of 1911-13 = 100.)

Month	1932	1933	1934	1935	1936	1937
January	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	140
May	115	102	112	111	115	133
June	111	100	110	111	116	131
July	106	101	114	114	117	—
August	105	105	119	113	119	—
September	104	107	119	120	127	—
October	100	107	114	113	125	—
November	101	109	114	113	125	—
December	103	110	113	114	126	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and the Cattle Industry (Emergency Provisions) Act (b).

Month	1932	1933	1934	1935	1936	1937
January	—	111	119	124	125	133
February	—	110	117	122	123	133
March	—	106	112	118	122	134
April	—	109	116	126	128	143
May	—	105	116	117	120	136
June	—	104	114	117	121	134
July	—	104	117	120	121	—
August	108	108	122	120	124	—
September	108	111	125	128	133	—
October	104	112	121	119	129	—
November	105	113	120	119	129	—
December	107	114	120	120	130	—

(a) Commenced August, 1932.

(b) Commenced September, 1934.

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In the following table the monthly index numbers of prices of individual commodities are shown for the months of March to June, 1937, and June, 1936, and June, 1935; base, the corresponding months of 1911-13=100.

Commodity	1937				1936	1935
	June	May	Apr.	Mar.	June	June
Wheat	123	124	131	121	84	69
Barley	129	133	132	124	92	94
Oats	120	119	119	115	82	98
Fat cattle	111	112	106	102	98	90
„ sheep	152	160	153	145	131	124
Bacon pigs	114	118	119	122	119	105
Pork „	113	116	117	124	112	103
Eggs	129	112	112	121	114	107
Poultry	132	122	113	123	124	123
Milk	162	162	215	171	162	162
Butter	109	106	104	100	98	89
Cheese	122	112	109	110	108	98
Potatoes	189	196	191	200	160	137
Hay	98	100	100	101	83	100
Wool	138	141	138	130	94	85
Dairy cows	115	112	112	111	103	100
Store cattle	117	115	109	105	96	92
„ sheep	132	133	128	117	119	100
„ pigs	127	125	126	129	122	115

Revised index numbers due to payments under the Wheat Act and the Cattle Industry (Emergency Provisions) Act.

Wheat	125	125	131	134	115	109
Fat cattle	125	126	120	117	111	104
General Index	134	136	143	134	121	117

Grain. Wheat averaged 9s. 9d. per cwt. in June or 1d. per cwt. less than in May, and the index declined by 1 point. Barley at 9s. 7d. per cwt. showed a fall of 7d. per cwt. on the month, and this is reflected in a reduction of 4 points in the index. On the other hand, oats at 9s. per cwt. rose by 2d., and the index is slightly higher than in May. In June, 1936, wheat averaged 6s. 8d., barley 6s. 10d., and oats 6s. 2d. per cwt.

Livestock. After rising almost continuously for over six months prices of fat cattle fell during the early part of June and then recovered. The monthly average of second quality fat cattle at 41s. 5d. per live cwt. was 1d. lower than in May, and this, combined with a slight rise in the base price, was sufficient

MISCELLANEOUS NOTES

to reduce the index by 1 point. The addition of the subsidy under the Cattle Industry (Emergency Provisions) Act, 1934, brings the index from 111 up to 125. The seasonal fall in prices of fat sheep continued during June, and as the reduction of 1d. per lb. for second quality was greater than in the base period the index moves downwards by 8 points. Baconers and porkers at 11s. 1d. and 11s. 7d. per score of 20 lb. respectively, both declined by 7d. per score; the index for the former falls by 4 points and that for the latter by 3 points.

Dairy cows and store cattle were dearer than a month earlier and the indices move upwards by 3 and 2 points respectively. Store sheep were cheaper, and the index falls by 1 point. The average price of store pigs declined from 30s. 3d. to 29s. 10d. each, but as the reduction was less than in the base period the index rises by 2 points.

Dairy and Poultry Produce. The regional contract price of liquid milk was unchanged in June and the index continues at 162. At 1s. 0½d. per lb., butter was ½d. per lb. lower than in May compared with a reduction of ½d. per lb. in the base months; in consequence the index number is 3 points higher than in May. The seasonal rise in the price of eggs continued during June, and the average of second quality eggs at 11s. 3d. per 120 was 2s. 1d. per 120 more than a month earlier. This increase was considerably greater than in the base period and is reflected by an upward movement of 17 points in the index. At £4 5s. per cwt. cheese was 3s. 6d. per cwt. higher than in May and the index is increased by 10 points.

Other Commodities. Prices of potatoes rose slightly during June to £8 17s. 6d. per ton, but the index declines by 7 points owing to a greater increase in the corresponding months of 1911-13. Both clover and meadow hay were slightly lower in price, and the combined index shows a fall of 2 points. Wool at an average of 1s. 5½d. per lb. was reduced by ½d. per lb., and the index moves downwards by 3 points.

The Agricultural Economics Society's Essay Competition

The results of the 1936-37 Essay Competition of the Society have been announced as follows:—

The first prize of £10 has been awarded to Mr. R. G. Betterton, The Institute of Agriculture, Moulton, Northampton, for an essay on "The Stimulation of Consumption rather than the Restriction of Supplies must be the basis of British Agricultural Policy."

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The second prize of £5 has been awarded to Mr. W. E. Richards, Agricultural Economics Department, Reading University, for an essay on "Changes in the Value of the Agricultural Output of Great Britain in Relation to the Number of Persons Employed and the Earnings of the Employees."

Advisory Leaflets

Since the date of the list published in the April, 1937, issue of this Journal (p.95), the undermentioned Advisory Leaflets have been issued by the Ministry:—

- No. 50.—Thistles in Grass Land (Revised).
- No. 51.—Thistles on Arable Land (Revised).
- No. 109.—Flea Beetles (Revised).
- No. 112.—Rearing and Marketing of Geese (Revised)
- No. 154.—Fruit Tree Capsids (Revised).
- No. 254.—Tawny Owl and Little Owl (Revised).
- No. 282.—Allotment Cultivation.

Copies of any of the above-mentioned leaflets may be purchased from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or at the Sale Offices of that Department at Edinburgh, Manchester, Cardiff, and Belfast, price 1d. each net (1½d. post free), or 9d. net per doz. (10d. post free).

Single copies of not more than 20 leaflets may, however, be obtained, free of charge, on application to the Ministry. Further copies beyond this limit must be purchased from H.M. Stationery Office, as above.

A list of the Ministry's publications, including leaflets, on agriculture and horticulture may be obtained free and post free on application to the Ministry.

The Jones-Bateman Cup for Research in Fruit-growing

The Royal Horticultural Society has intimated that the Jones-Bateman Cup is available for award this year. The Cup, a valuable silver-gilt replica of the Warwick Vase, was presented to the Society, in 1920, by Miss L. Jones-Bateman, of Cae Glas, Abergele, as a trophy to be used for the encouragement of fruit production. The Society accordingly decided to offer it triennially for researches in the growing of hardy fruits, figs, grapes and peaches in the open or under glass.

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Candidates for the award must submit accounts of their work by October 30, 1937, addressed to the Secretary, Royal Horticultural Society, Vincent Square, Westminster, S.W.1. Three assessors, two appointed by the Society and one by the National Farmers' Union, will report to the Council of the Society upon the originality and comparative potential value to the fruit-growing industry of the work of the respective candidates. The Council will award or withhold the Cup at its discretion.

A successful candidate will hold the Cup for three years, giving a bond for its safe return; and, on returning it to the Society, will receive a Hogg medal specially struck in gold. Winners of the award are eligible to compete on the next or any subsequent occasion.

Advice on Camps for Hop-pickers

The Ministry of Health has issued an attractively printed booklet* for the use of hop growers who are responsible for hop-pickers' camps during the season of hop-picking. Model by-laws, issued for the use of local authorities, and concerning all growers, not only of hops but of fruit and vegetables, who are interested in providing lodging and accommodation for persons engaged in picking those crops, were issued earlier in the year and appeared in this JOURNAL for June, 1937.

The booklet deals fully with such matters as lodging, cooking, drying, water supply and sanitation. District Councils are responsible for seeing that a satisfactory standard of hygiene is maintained in such camps and they have power to make bylaws on the subject. The Ministry of Health's model bylaws, referred to above, have helped Councils in many instances to draw up satisfactory bylaws for their districts, but in some other districts it will be found that the local bylaws vary from the model. Growers should, therefore, in their own interests, get from their own District Councils a copy of the bylaws in force locally and so ascertain the precise requirements they have to meet.

* To be obtained free of charge from The Secretary, Ministry of Health, Whitehall, London, S.W.1.

MISCELLANEOUS NOTES

Foot-and-Mouth Disease. No further outbreak of Foot-and-Mouth Disease occurred in either the Devon or the Surrey Infected Area and consequently these Areas were released from restrictions on June 28 and July 1, respectively.

An outbreak was confirmed at Eyemouth, Ayton, Berwickshire, on June 28, and the usual restrictions were imposed over an area of approximately 15 miles radius round the infected premises. The Infected Area covered parts of the counties of Berwick, East Lothian and Northumberland. Three further outbreaks in the same Infected Area were confirmed, on July 2, 3 and 4 respectively, and an extension of disease on one of the premises where disease had previously existed was confirmed on July 9. These outbreaks did not, however, make any extension of the Infected Area necessary. The Area was reduced to one of approximately 5 miles radius round the Infected Premises on July 17. Provided the disease position remains satisfactory, the area will be released from restrictions on July 30.

Enforcement of Minimum Rates of Wages. During the month ending July 12, 1937, legal proceedings were taken against three employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow.—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No of workers involved
Cheshire ..	Winsford ..	£ s d. 20 0 0	£ s d. —	£ s d. 43 14 8	1
Lancashire ..	Leigh ..	(a)	—	18 10 8	1
Yorkshire, West Riding	Doncaster	12 0 0	—	53 13 2	3
		32 0 0	—	115 18 6	5

(a) Dismissed under the Probation of Offenders' Act.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Leicestershire: Mr. H. R. Kirby, N.D.A., has been appointed Assistant Agricultural Organizer, *vice* Mr. L. E. Edney, B.Sc.(Agric.).

Lincolnshire (Holland): Mr. J. Hargrave, B.Sc., has been appointed Chief Agricultural Chemist, *vice* Mr. F. W. Handley, B.Sc., Ph.D. Mr. F. C. Thompson, B.Sc., has been appointed Assistant Agricultural Chemist.

Middlesex: Mr. R. Duncan, N.D.H., has been appointed Superintendent of Commercial Horticulture, *vice* Mr. P. E. Cross, N.D.H.

Somersetshire: Mr. J. L. Congdon, N.D.H., has been appointed Assistant Agricultural Organizer, *vice* Mr. A. T. G. Trew, N.D.A., N.D.D.

STAFFS OF AGRICULTURAL COLLEGES

Studley College, Warwickshire: Mr. H. Montgomery, N.D.A., has been appointed Farm Manager in succession to Mr. E. Duddles, C.D.A.

WIRELESS TALKS, AUGUST, 1937

AGRICULTURAL

<i>Station and Date</i>	<i>Time p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National, Midland and Scottish :	—	—	No talks in August.
North : August 2	6.50	Professor J. A. Hanley.	Account of the Durham County Show
„ 11	7.10	Professor J. A. Hanley.	Account of Northumberland Agricultural Show
West : August 12, 26	8.0	—	Fortnightly Letter to Western Farmers.
Northern Ireland : August 27	—	Mr. Peter Fitzpatrick	Farmers' Work and Worry

HORTICULTURAL

<i>Station and Date</i>	<i>Time p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National August 6	7.15	Mr T Hay	In Other Gardens.
„ 13	7.15	Mr. Clarence Elliott	In Other Gardens.
„ 20, 27	7.15	Not fixed	In Other Gardens.
North : August 20	7.0	Messrs. K. A. Therkildsen and W. E. Shewell-Cooper	Climbing Plants.
West : August 17	9.30	Not fixed	For Western Gardeners.
Scottish : August 4	6.20	Mr. Alexander Keith	August in the Garden.
„ 26	6.40		
Northern Ireland : August 4	8.45	Mr H G Fleet	An Ulster Garden.
„ 30			

SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

Developments Tending towards an Improved Utilisation of the Horse, Recent Studies in the Construction of Farm Carts and their Improvement. *E. Moskovits*. (Int. Rev. Agric. Mon. Bull. Agric. Sci. and Pract. 28, 4. (April, 1937), pp. 1211-1321.)

Dormant Roots and Buds of the Cricket Bat Willow—*Salix Caerulea*—and their Effects on the Wood. *H. P. Hutchinson*. (J. Bath W.S. Co. Ass. 6th Series, xi (1936-37), pp. 98-101 + 3 plates.)

The Effects of the Removal and Retention of Lateral Branches in the Production of Sets of the Cricket Bat Willow. *H. P. Hutchinson*. (J. Bath W. S. Co. Ass. 6th Series, xi (1936-37), pp. 101-104.)

Agricultural Economics

Agricultural Indebtedness: (1) General Survey of the Question; (2) Agricultural Debts and their Adjustment. *G. Costanzo*. (Int. Rev. Agric. Mon. Bull. Agric. Econ. and Soc. 28, 1 (Jan. 1937), pp. 1E-33E.)

Agricultural Indebtedness, (B) Scandinavian Countries. *G. Costanzo*. (Int. Rev. Agric. Mon. Bull. Agric. Econ. and Soc. 28, 2 (Feb. 1937), pp. 45E-52E.)

Agricultural Indebtedness, (C) Countries of Central and Eastern Europe. *G. Costanzo*. (Int. Rev. Agric. Mon. Bull. Agric. Econ. and Soc. 28, 3 (March, 1937), pp. 73E-97E.)

Economic Conditions and Policies Affecting Agriculture During the World Economic Depression. *A. Emanuel*. (Int. Rev. Agric. Mon. Bull. Agric. Econ. and Soc. 28, 1 (Jan. 1937), pp. 33E-41E and 28, 2 (Feb. 1937), pp. 53E-66E.)

Agricultural Education

Technical Instruction and the Agricultural Worker. *W. R. Seward*. (J. Fmrs.' Cl., Lond., Pt. 3 (April, 1937), pp. 37-53.)

In the Beginning: A Series of Articles Dealing with the Development of Agricultural Educational and Research Institutions. I. Rothamsted Experimental Station. *Sir E. J. Russell*. (Agric. Progr. 14, 1 (1937), pp. 1-13.)

Botany and Plant Physiology

A Review of the Problem of Bud Dormancy. *R. H. Stoughton*. (Sci. Hort. 5 (1937), pp. 115-125 + 2 plates.)

Plant Hormones and their Possible Importance in Horticulture. *M. Thomas*. (Sci. Hort. 5 (1937), pp. 141-152 + 4 plates.)

Crops

Grass Drying. *The Earl Waldegrave and W. T. Price*. (J. Bath W. S. Co. Ass. 6th Series, xi (1936-37), pp. 11-31 + 3 plates.)

Keeping Quality of Sugar Beets as Influenced by Growth and Nutritional Factors. *F. G. Larmer*. (J. Agric. Res. 54, 3 (1 Feb. 1937), pp. 185-198.)

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Dairying and Milk Products

- Some Observations on Grade "A" Milk. *J. O. Eastbach and E. J. Sherwood.* (Fm. Econ. No. 99 (Feb. 1937), pp. 2419-2426.)
- The Problem of Proving Dairy Bulls. *St. Taussig.* (Int. Rev. Agric. Mon. Bull. Agric. Sci. and Pract. 28, 3 (March, 1937), pp. 691-811.)
- Mastitis Milk in Cheese-making. *R. H. Leitch.* (Agric. Progr. 14, 1 (1937), pp. 40-43.)
- Grassland Dairying in the Blackmore Vale. *E. Thomas and F. H. Villiers.* (J. Brit. Dairy Fmrs' Ass. 49 (1937), pp. 9-25.)
- Dairy Changes in Village Life. *E. Walker.* (J. Brit. Dairy Fmrs' Ass. 49 (1937), pp. 38-48.)
- Applied Bacteriology in Dairying. *A. T. R. Mattick.* (J. Brit. Dairy Fmrs' Ass. 49 (1937), pp. 49-58.)
- The Present State of the Dairying Industry in the Various Countries : (9) Poland, (10) Bulgaria, (11) Latvia. *E. Gasser.* (Int. Rev. Agric. Mon. Bull. Agric. Sci. and Pract. 28, 2, 3 and 4 (Feb., March and April, 1937), pp. 51-62, 89-97 and 133-139.)

Diseases of Animals and Veterinary Science

- Poisonous Plants. *A. R. Horwood.* (J. Land. Agents' Soc. 36, 3 (March, 1937), pp. 107-113.)
- Sheep Scab: Remedial Measures Reviewed. *E. A. Lewis.* (Bull. ent. Res. 28, 1 (March, 1937), pp. 11-28 + 1 plate.)
- Causes of Loss in Sheep. *J. F. H. Thomas.* (J. Bath W. S. Co. Ass. 6th Series, xi (1936-37), pp. 34-42.)

Fertilizers

- Peat and Its Uses in Horticulture. *W. G. Ogg.* (Sci. Hort. 5 (1937), pp. 153-161.)
- Formamide as a Nitrogenous Fertilizer. *C. J. Rehling and J. R. Taylor, Jr.* (J. Amer. Soc. Agron. 29, 2 (Feb. 1937), pp. 134-144.)
- Manurial Experiments on Vegetable Crops in Lancashire. *W. L. Steer.* (Sci. Hort. 5 (1937), pp. 34-38.)
- The Necessity of Livestock and Organic Manure in Mechanical Farming. *W. D. Hollis.* (J. Fmrs' Cl., Lond., Pt. 2 (March, 1937), pp. 21-36.)

Food, Nutrition and Preservation

- The Keeping Qualities of Apples in Relation to their Maturity when Gathered. *F. Kidd and C. West.* (Sci. Hort. 5 (1937), pp. 78-86.)
- Bacteriological Aspects of Refrigeration in the Dairy Industry. *J. G. Davis.* (Proc. Brit. Ass. Refrig. 33, 1 (1936-37), pp. 125-134.)
- The Relative Potency of Vitamin D from Different Sources. *E. Margaret Hume.* (Nutr. Abstr. Rev. 6, 4 (April, 1937), pp. 891-901.)

Fruit Culture and Horticulture

- Grafting Fruit Trees. *W. E. Shewell-Cooper.* (Estate Mag. 37, 4 (April, 1937), pp. 297-301.)
- A Survey of the Soils and Fruit in the Vale of Evesham, with Special Report on Vegetable Crops (Summary). *T. Wallace.* (J. Bath W. S. Co. Ass. 6th Series, xi (1936-37), pp. 81-97 + 4 plates.)
- Science Progress Applied to Horticulture. *G. Truffaut.* (J. Roy. Hort. Soc. 62, 3 (March, 1937), pp. 100-111.)
- The Potato in Its Early Home and Its Introduction into Europe (contd.). *R. N. Salaman.* (J. Roy. Hort. Soc. 62, 3 (March, 1937),

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- pp. 112-123 + 4 plates and 62, 4 (April, 1937), pp. 153-162 + 6 plates)—(to be continued.)
 The Pot Plant Industry. *W. Corbett.* (Sci. Hort. 5 (1937), pp. 98-106 + 2 plates.)
 Timber for Glasshouse Construction. *J. Bryan.* (Sci. Hort. 5 (1937), pp. 107-114.)
 Recent Dutch Research on the Growth and Flowering of Bulbs.
 I. The Temperature Requirements of Hyacinths. *Miss O. N. Parvis.* (Sci. Hort. 5 (1937), pp. 127-140.)
 The Routine Management of Lawns. *R. B. Dawson.* (Sci. Hort. 5 (1937), pp. 167-178 + 4 plates.)
 The Care of Ornamental Trees. *A. D. C. Le Sueur.* (J. R. Hort. Soc., 62, 4 (April, 1937), pp. 141-152.)

Livestock, Breeding and Feeding

- Cacao Shell as a Foodstuff for Cattle. *J. Golding and H. Burr.* (Agric. Prog. 14, 1 (1937), pp. 44-52.)
 Sheep Nutrition. I. Measurements of the Appetites of Sheep on Typical Winter Rations, Together with a Critical Study of the Sheep Feeding Standards. II. Determination of the Amounts of Grass Consumed by Sheep on Pasturage of Varying Quality. *H. E. Woodman, R. E. Evans and A. Eden.* (J. Agric. Sci. 27, 2 (April 1937), pp. 191-223.)
 Grass Silage—A Comparison of the Changes Involved in the Ordinary Molasses, and A.I.V. Processes. *W. M. Davies, G. H. Botham and W. B. Thompson.* (J. Agric. Sci. 27, 2 (April, 1937), pp. 151-161.)
 The Time of Cutting Hay, and the Losses Entailed During Hay-making. *S. J. Watson, W. S. Ferguson and E. A. Horton.* (J. Agric. Sci. 27, 2 (April, 1937), pp. 224-258.)
 The Effect of the Addition of Various Materials and Bacterial Cultures to Grass Silage at the Time of Making on the Subsequent Bacterial and Chemical Changes. *L. A. Allen, S. J. Watson and W. S. Ferguson.* (J. Agric. Sci. 27, 2 (April, 1937), pp. 294-308.)

Plant Diseases and Pests

- Amillaria mellea*.—"The Death"—A Trouble of Fruit Trees Due to Root Suffocation. *B. S. Furneaux and W. G. Kent.* (Sci. Hort. 5 (1937), pp. 67-77.)
Aecidium Grossularia DC (*Puccinia Pringsheimiana* Kleb).—On the Control of Gooseberry Rust. *W. R. Saunderson and H. Cairns.* (Ann. Appl. Biol. 24, 1 (Feb. 1937), pp. 17-25 + 1 plate.)
Phytophthora infestans.—The Control of Blight in Seed Potatoes by Tuber Disinfection. *T. N. Greeves.* (Ann. App. Biol. 24, 1 (Feb. 1937), pp. 26-32 + 1 plate.)
 Notes on Apple Canker. *R. W. Marsh.* (J. Bath W. S. Co. Ass. 6th Series, xi. (1936-37), pp. 42-47.)
Anguilulina dipsaci (Kühn) as a Cause of Parsnip "Canker." *C. L. Walton.* (J. Bath W. S. Co. Ass. 6th Series, xi (1936-37), pp. 111-114 + 2 plates.)
 Experiments on the Control of Lichen on Apple Trees by Means of Tar Oil Washes. *J. E. Forshaw, H. G. Kearns and H. Martin.* (J. Bath W. S. Co. Ass. 6th Series, xi (1936-37), pp. 114-119 + 1 plate.)
 The Control of the Insect Pests of Nursery Fruit Stock. *H. G. H. Kearns and E. Umpleby.* (J. Bath W. S. Co. Ass. 6th Series, xi (1936-37), pp. 120-128.)

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Heterodera schachtii.—The Effect of Nitrogenous Fertilizers on Potatoes Affected with Potato Sickness. C. L. Walton, L. Ogilvie and C. J. Hickman. (J. Bath W. S. Co. Ass. 6th Series, xi (1936-37), pp. 129-134.)

The Incorporation of Direct with Protective Insecticides and Fungicides, II. The Effects of Spray Supplements on the Retention and Tenacity of Protective Deposits. E. Fajans and H. Martin. (J. Pomol. 15, 1 (April, 1937), pp. 1-24.)

Bacteriosis of Cherry Trees: Relative Susceptibility of Varieties at East Malling. N. H. Grubb. (J. Pomol. 15, 1 (April, 1937), pp. 25-34.)

Bacteriosis of Stone Fruit Trees in Britain. VI. Field Observation. on Bacteriosis of Sweet Cherry Trees. H. Wormald. (J. Pomol. 15, 1 (April, 1937), pp. 35-48 + 4 plates.)

Investigations on Egg-killing Washes. II. The Ovicidal Properties of Hydrocarbon Oils on *Aphis Pomi* de Geer. H. G. Kearns, H. Martin and A. Wilkins. (J. Pomol. 15, 1 (April, 1937), pp. 56-68.)

Recent Research on Wood-Destroying Insects. R. C. Fisher. (J. R. Soc. Arts, 85, 4400 (March, 1937), pp. 407-425.)

The Insects Associated with Bracken. A. A. Meshle. (Agric. Progr. 14, 1 (1937), pp. 58-60.)

Soils and Weeds

Problems of Horticultural Soils. G. W. Robinson. (Sci. Hort. 5 (1937), pp. 162-166.)

The Bracken Eradication Problem. K. W. Braid. (Agric. Progr. 14, 1 (1937), pp. 29-39.)

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Agricultural Survey of the Northern Province, the Counties of Durham, Northumberland, Cumberland, Westmorland. By J. A. Hanley, A. L. Boyd and W. Williamson. Pp. 123. (Newcastle-upon-Tyne: Department of Agriculture, Armstrong College, 1936.)

This is the second agricultural survey, dealing with a particular area of this country, which has come to hand recently. The first was Professor Stapledon's Survey of Wales. The present one deals with an area which has, from the agricultural point of view, much in common with Wales. The survey has examined the type of holding, livestock population, the system of cropping, soils, water supplies, and meteorological data of Durham, Northumberland, Cumberland and Westmorland, and has given careful consideration to the economic factors that affect the farming of particular regions and its variation throughout the region. The survey forms a useful basis for future work since it divides the whole area into districts in which the farming system is fairly uniform, and which may be expected, as the authors indicate, to form units for some future and more intensive inquiry.

Among the conclusions reached by the authors as a result of the survey may be noted the one that "improved utilization of land with increased output is possible in most districts . . . but the suitability of districts for an increase in output by the use of intensive methods varies considerably."

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An Outline of Cytological Technique for Plant Breeders. Foreword by Sir A. Daniel Hall. Pp. 14. (Cambridge: Imperial Bureau of Plant Genetics. 1937. Price 1s. 6d.)

A knowledge of cytology and some acquaintance with its technique has now become essential to the plant breeder. This bulletin gives an account of the standard methods used in plant cytology, based on practical experience rather than a survey of the literature of the subject. The introduction deals with the value of cytology in plant breeding, and is followed by general remarks on technique and descriptions of the paraffin method, including staining with iron alum-hæmatoxylin and with gentian violet, the aceto-carmin technique (a method particularly useful for plant breeders) and smears with standard fixatives and stains. Hints are given on the use of the microscope, and the bulletin concludes with a list of fixatives, with formulæ and a brief bibliography. While this publication is primarily intended for plant breeders, it will be found useful by all who desire an acquaintance with the standard methods employed in plant cytology.

Le Soja dans le Monde. (*The Soya Bean all over the World*). Pp. viii + 282. (Rome: Institut International d'Agriculture, Villa Umberto I. 1936. Price 10 lire.)

The origin of this work was a questionnaire which was sent out by the International Institute of Agriculture to secure information on the cultivation and utilization of the Soya Bean in all the countries where it is cultivated. The replies to this questionnaire have been condensed and are now published in a readily comprehensible form. Perhaps the most important part of the book, from a British point of view, is that which deals with the cultivation of the bean. The conclusions which are come to are that, generally speaking, the Soya Bean demands the same sort of soil as maize, but that it grows better than maize in less fertile soils if they have been inoculated. As far as cultivation is concerned the soil should be prepared in much the same way as it is for maize and the bean responds to extra cultivations as does maize.

As with other legumes the Soya Bean can use atmospheric nitrogen by means of the nodule bacteria of its roots, and for this reason inoculation of the soil is recommended. The bean is usually sown in drills to allow of after-cultivation, but the yields are not very high in any of the countries where it is grown. For instance, in Manchuria, where it is indigenous, the average yield per acre is 20 bushels, while in Japan, Korea, and China the average yields respectively are 16, 10 and 15 bushels per acre. However, on the experimental farms in South Africa 34 bushels have been obtained, and in Canada 36, while in the United States of America yields varying between 30 and 40 bushels have been obtained, and in North Carolina a maximum of 50 bushels. If an acclimatized variety can be discovered which will give yields of this order in this country, there is undoubtedly a future for the crop in the farm economy of Britain, but a perusal of this publication does not for the present hold out very much hope in this direction.

German Agricultural Policy, 1918-1934. By J. B. Holt. Pp. x + 240. (Chapel Hill, University of North Carolina Press; London: Oxford University Press. 1936. Price 11s.)

This book, based on the author's Ph.D. dissertation submitted to the University of Heidelberg, treats of agricultural policy along lines of thought probably more familiar in Germany than here. British writers have usually discussed agricultural policy in the light of what any given policy has attempted, of its success in those attempts, and of what it

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might alternatively have aimed at. Dr. Holt's treatment, on the other hand, might almost be described as etiological; he is concerned primarily with that succession of political environments which in Germany favoured first the predominance of one form of agricultural policy and then another. Each of these political environments is dissected down to its essentials—the prevailing balance of voting power among the groups representing the material interest of the urban working classes, the industrialists, the large landowners and the small farmers. In the study of a country like pre-National-Socialist Germany, where the rival interests were generally of comparable strength, and Governments were based on coalitions of the various interests, this method has a purpose worth serving.

From the point of view of the British reader, the book at many points presupposes an acquaintance both with German politics and with German agriculture that is not likely to be often combined in the same individual; but to any reader it will be useful in that it does, in general, adequately describe and account for the increasing emphasis in German agricultural policy of the motive of self-sufficiency. The political transition from Social Democracy immediately after the war to National-Socialism in 1933, seems to have been accompanied by a steady increase in the influence commanded by agriculture as a claimant for special rights and privileges within the general economy, and by a like increase in the influence of those political groups that have been most concerned with safeguarding Germany against a recurrence of the food shortage that contributed to her defeat in 1918. As far as agriculture is concerned, the reader will particularly notice that the trend of policy has been continuous—the special place now occupied by agriculture in the Four Year Plan of self-sufficiency represents no innovation, but is the culmination of some fifteen years of special attention given to the increase of agricultural output, without too much regard to the cost of living.

This steady progression in the development of German agriculture did not, however, prevent the emergence of a conflict of interest between grain growers and animal feeders; and, as in other countries, this conflict became acute when the decline of grain prices turned into a collapse shortly before the general depression. For reasons which the author adequately describes on the political side, the decision on this matter was given in Germany in favour of the growers, and tariffs on grain were raised *pari passu* with the descent of external prices. Although the author brings his study down to 1934, he has perhaps missed an opportunity in not more fully describing how this and many other conflicts of agricultural interest have now been resolved by the National-Socialist regime under its system of generalized price and production control. Nor does he in any detail describe the post-1933 agricultural policy by reference to what might be considered the vital factor of foreign exchange stringency.

The angle from which the latest phases of German agricultural policy are approached is perhaps best indicated by the sub-title used—"The Yeoman Nobility of National-Socialism." Under this general heading the author provides an account of the "Inherited Freehold Policy," and of the National-Socialist policy regarding land settlement and agricultural credit. The two last topics are not, however, discussed very fully, and there is more of interest in the examination which is made of the Inherited Freeholds and of their origins in the ideology associated with the words "Blood and Soil."

The Profitable Culture of Vegetables. By T. Smith. Revised by W. E. Shewell-Cooper, N.D.H., F.L.S., Dip.Hort. Pp. xiv + 334. Illus. (London: Longmans, Green & Co. 1937. Price 7s. 6d.)

Issued first in 1911 this book has remained a favourite with vegetable

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growers for reference purposes. New impressions appeared in 1913, 1919 and 1932. The present impression has been prepared by the Horticultural Lecturer at Swanley Horticultural College, who has brought the information up to date. The chapters on intensive gardening, mechanical cultivation, transplanting machines, overhead irrigation, sterilization of the soil by baking, and the protection of crops by the use of heaters contain very modern ideas on the subjects. Details for individual vegetables are given at some length so that the cultivation for each one can be followed. There are numerous illustrations, many of which appear for the first time in this edition. In its new form the book should remain a standard work for the industry.

The Hill Country of Northern New England: Its Social and Economic History, 1790-1930. By Harold Fisher Wilson. Pp. xiv + 455. Illus. (New York: Columbia University Press; London: Humphrey Milford. 1936. Price 21s.)

It is impossible to do any better in reviewing this work than to quote extensively from the Editor's foreword. The northern part of New England was settled at a comparatively early date in the history of the United States, and the land was reclaimed and broken up into small self-sufficient farms. The district was isolated from markets by the lack of good roads and by the difficulties of the climate, but it was possible for the hardy settlers to grow enough food for themselves and their animals. The few things that were exported in the summer made it possible for them to buy the manufactured necessities that were essential to their continued existence. With the exploration of the Middle West the young people on the farms of Northern New England went West to find more fertile farms and a better chance of life. This was very bad for Northern New England in two ways. It took away the basis of its population and it created a more severe competition for the exportable commodities.

Soon after the end of the Civil War matters reached a climax. In spite of the attempts that had been made to develop commercial agriculture in the district, the difficulties proved too great to combat. There was a widespread desertion of farms, and a pronounced decline in population during the closing decades of last century. It looked as if the countryside would be permanently deserted, but the first three decades of the twentieth century proved this to be incorrect. By turning to dairying, fruit, potato, poultry and garden produce the Northern New England farmer has survived, and the development of modern conveniences has tended to make his farming technically more efficient. In addition, the countryside has become popular as a recreational district, with a resulting increase in the farmers' income.

The story of Northern New England is, that it has been repeatedly compelled to readjust itself to changing conditions, and the story of these readjustments and the conditions which caused them as a whole are well told in Dr. Wilson's book.

Agricultural Prices. By F. L. Thomsen, Ph.D. Pp. x + 471. (London: McGraw-Hill Publishing Co. 1936. Price 24s.)

In the course of his duties as Professor of Agricultural Economics at the University of Missouri, Dr. Thomsen has come to realize the need for a text-book on agricultural prices. During the past decade much progress has been made in price analysis, with the result that a large amount of information on the subject is scattered about in mimeographed memoranda, scientific periodicals, bulletins, works of reference and other publications. This volume represents an attempt to supply the need by assembling the most usable of these materials in a form convenient for

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educational purposes. The author recognizes the difficulties of his task and does not expect that, in the present state of knowledge, any book on the subject can be entirely satisfactory. Reference to local and contemporary conditions has been omitted except where these serve merely to illustrate matters of principle, and wisely no attempt has been made to evaluate current trends in commodity prices or to predict future events. The book is designed for the classroom, but should also prove helpful to farmers, business men, officials of co-operative organizations and others who desire to familiarize themselves with the elements of this very practical study.

Tuberculin-tested Milk: A Study of Reorganization for its Production.

By R. N. Dixey. Pp. 111. (Oxford: Agricultural Economics Research Institute. 1937. Price 2s. 6d.)

The introduction of a Marketing Scheme for milk, together with a substantial revision of the Milk (Special Designations) Order, 1936, has given widespread publicity to the present standard of milk production, and to the unique value of milk as a human food.

The production of tuberculin-tested milk, although still representing a small percentage of the total output, is being attempted by an increasing number of producers, and for this reason the publication of a record of the experiences of pioneer producers is particularly opportune. It contains a record of the reorganization undertaken on some 180 farms and of the extra capital involved. It was found that no fewer than 84 per cent. of the cowsheds needed alteration or rebuilding, and new sheds, at an average cost of nearly £26 a stall, were built on 9 per cent. of the farms. The average costs incurred in bringing the cowsheds to the required standard amounted to £5 16s. per stall. Three farms out of every four needed improved milk-room accommodation, and the average cost is calculated at £1 4s. 3d. per cow. Similarly, the extra equipment for washing and sterilizing, and the supply of clippers, brushes, smocks, towels, covered pails, etc., added a further cost of £2 11s. per cow. The extra cost involved through the replacement of reacting cows by cows in sound health is discussed at length, and, subject to reservations, is given at £3 9s. 9d. per cow. The average cost of all these requisites in the production of this grade of milk works out at £13 1s. per cow.

These are merely the hard financial facts, but the wider knowledge of the author, together with his close contact with many of the producers concerned, has enabled him to include much information of a valuable nature drawn from the personal experiences of these producers.

Finally, an attempt is made to estimate the probable cost of establishing a liquid milk supply on the basis of a tuberculin-tested milk standard. It is appreciated that many problems are involved, and that it is a question of general and national policy affecting not only the welfare of dairy herds and milk producers, but also the general health of the nation.

National Income and Outlay. By Colin Clark, M.A. Pp. xix + 304. (London: Macmillan & Co., Ltd. 1937. Price 12s. 6d.)

In 1932 Mr. Clark published *The National Income, 1924-1932*. He has now brought his former calculations up to date and considerably extended their range, the result being a comprehensive treatise of unquestionable importance to all who are interested in the quantitative study of economic data. In addition to the estimate of the national income, which is reached by a combination of several independent methods, the book includes a study of historical statistics on the subject (starting from Gregory King's estimate of 1696), an analysis of the productive sources of income at

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different periods, a detailed treatment of changes in consumption, investment, prices, and costs during the trade cycle 1929-36, and a final chapter embodying a general review of the rate of economic progress, past and present.

It is impossible in a brief space to summarize all his conclusions, still less to detail his methods. He finds that between 1929 and 1932, the net national income fell by 12 per cent., but that it has since regained the 1929 level, the latest figures given (relating to the first six months of 1936) being about 3 per cent. above the figure for 1929. The quantity of goods and services produced per person in work has risen since 1929 by almost 12 per cent. Against this has to be set a loss of income from overseas investment, but this is much more than balanced by the cheapening of imported goods relatively to the exports exchanged for them, so that real income (as opposed to output) per person in work has risen by as much as 13.2 per cent. This increase, however, is very much lessened when account is taken of the rise in unemployment; in fact, Mr. Clark's figures lead him to the conclusion that nearly the whole of the increase (of 15 to 20 per cent.) in productivity per person in work since 1913 has been absorbed by increased unemployment. The relative fall in import prices has nevertheless permitted a considerable rise in consumption, and "during recent years of low food prices it has been about true to say that an unemployed man with a wife and two children drawing benefit has been better off than an unskilled labourer in full work in 1913."

The author's estimates of the net output of agriculture will, of course, be of particular interest to the readers of this *Journal*. The latest official estimate of £191.7 millions relates to Great Britain and is an average for the years 1924-25 to 1927-28 (not 1924-25 only, as Mr. Clark states). His estimates for the United Kingdom for the calendar years 1924 to 1928 work out at an average of £119 millions. The difference is accounted for partly by the fact that he deducts from the gross output the estimated expenditure on machinery, tools, tackle hire, fencing and draining, and other miscellaneous requirements, and also the estimated cost of landlord's repairs to buildings and costs of management. His figure for 1908, however, is £164 millions for Great Britain and Ireland together, against the official estimate of £108.6 millions (net) for Great Britain alone and of £45.6 millions (gross) for Ireland. Mr. Clark gives yearly estimates of the net output from 1924 to 1933. The figures for 1929 and following years are as follows (in millions): £110; £137; £119; £110; £121. Estimation of the net output of agriculture is notoriously a difficult matter, owing to the lack of reliable information on many important points. Mr. Clark's results, however, are extremely interesting and suggestive.

By the use of previous estimates, the author calculates that the net output per person occupied in agriculture, measured at 1913 prices, rose from £48.3 in 1688 to £74.3 in 1867 and £85.2 in 1908. Even in 1688, at the prices then prevailing, agriculture contributed less than half the national income. In 1911 it contributed 8 per cent., in 1924 only 3.4 per cent., the drop being partly due to the exclusion of the Irish Free State. By 1934 its share had risen to 4.1 per cent. On page 76 Tables 29 and 30 are erroneously referred to as Tables 23 and 24.

Canning Practice and Control. By O. Jones, F.I.C., and T. W. Jones, B.Sc. Pp. xii-254 and 74 Figs. (London: Chapman & Hall, Ltd. 1937. Price 25s.)

The need for a modern English text-book on canning has been felt for some time, and from the title of this volume it might appear that the need is now filled. Actually a more accurate description would be "The

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Industrial Chemist in the Cannery. At least 188 pages deal with Food Laboratory Control. This section of the work bears the impress of knowledge and experience of the subject, while the chapters entitled "Preliminary Statistics," "The Cannery and Preliminary Equipment" and "Canning," suffer by comparison; in these chapters there is a lack of order, and some inaccurate statements occur.

On page 11 in a section on "Site Value" is interpolated a paragraph on the pros and cons of refrigeration. Similarly, advice about can washing (page 31) is interpolated between a paragraph headed "Can Sizes" and a table of can capacity. A section entitled "Food Preparation" (pp. 13-24) deals with such diverse subjects as descriptions of machinery, standards, quality factors and control tests. The section on "Canning Operations" is followed by one on "Flooring," which one would expect to find near discussions on sites and buildings. These chapters require rearrangement. References to can-making on pages 8 and 29 leave the impression that most firms in this country manufacture their own cans, whereas most canners purchase their cans from specialist manufacturers. On page 23 there is a recommendation relating to the use of "sodium or potassium nitrite in hot pickle" although nitrites may not be added to food in this country. On page 41 certain centres of the can temperatures are referred to; these seem to be high for centre can temperature, particularly in the case of fruits, although correct as processing temperatures. On page 51 the occurrence of flat sours is incorrectly attributed, in one sentence, to can leaks; while a section on air conditioning for canneries is illustrated by photographs of a chewing-gum factory.

This is a useful manual for the young chemist who has had some experience in canning; for one who has not, a study of the references contained in the bibliography is an obvious necessity.

Corn and Corn Growing. By H. A. Wallace and E. N. Bressman. 4th Edition. Pp. 436 and 117 Figs. (London: Chapman & Hall, Ltd. 1937. Price 13s. 6d.)

Moderate qualities of maize or Indian corn have been grown in this country for fodder during the past fifty years, but under quite different conditions from those obtaining in the United States of America, where the crop grown for grain holds a position of great economic importance. This work deals with every aspect of the subject, and has been recognized as an authoritative text-book since its first appearance in 1923. It is now reissued in a revised and enlarged edition, embodying numerous corrections and adjustments, especially in the sections on economics and genetics. The statistical tables have been amplified and modernized, and a useful chapter has been added dealing with various commercial products and by-products.

The Preservation of Our Scenery. By V. Cornish, D.Sc. Pp. xiii + 91, and 12 Figs. (Cambridge University Press. 1937. Price 7s. 6d.)

This volume of essays and addresses includes the proposals made by the author on behalf of the councils for the Preservation of Rural England and Wales to the Government Committee on National Parks, and addresses to the British Association and other scientific bodies on measures for safeguarding scenic amenity in town and country. Dr. Cornish regards the preservation of scenery as "essential to the national well-being," and while recognizing that industrialism is a permanent feature of our national life, he makes a special plea for the preservation of the more notable scenic regions, and in particular for the preservation of a belt of open land along the 500 miles of cliffs for which our shores are so justly famed. The author's pencil drawings are of considerable merit, although not all of them have direct relevance to the title of the book:

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Deutsche Siedlung Raumordnung und Siedlungswesen im Reich und in den Kolonien (*German Land-Settlement at Home and in the Colonies*).

By Dr. J. H. Schultze. Pp. viii + 158. (Stuttgart: Ferdinand Enke Verlag, 3 Hasenbergsteige. 1937. Price RM.6.20.)

In this work Professor Schultze discusses the necessity of settling German nationals in the Reich and in some of the former German colonies. He defines "settling" as a redistribution of the population in such a manner as to secure that they become attached to their new environment. The suggested redistribution in Germany itself, he claims, should be helpful to the peasantry; it would relieve the pressure of population in the large cities and lead to the decentralization of industry. The author states that Germany requires 7.5 million hectares of land (some 18 million acres) for 500,000 small holdings and 0.75 million hectares (say 2 million acres) for 4½ million homesteads. Settlement on such a scale—even after the reclaiming of land on the coasts and cultivating moors and other barren lands—is an impossibility within Germany itself, consequently action must be amplified by development in German colonies overseas, especially in Africa.

Conditions de Production, Organisation et Résultats des Exploitations

Agricoles en Tchécoslovaquie. Edited by Dr. V. Brdlík. Pp. xxvii + 342, and 1 Map. (Prague: Institute of Accountancy and Rural Economy. 1935. Price *Cena Kč* 100.)

This publication summarizes in statistical form the results of an official inquiry into the conditions of agricultural production and organization in Czechoslovakia from 1926 to 1930. The results are given in Czechoslovakian, French and German, and are followed by an appendix in each of the three languages stating the principles on which the investigation was conducted. A detailed map indicates the districts in which the various agricultural enterprises are carried on.

Parliamentary Land Enclosures in the County of Nottingham During the 18th and 19th Centuries, 1743-1868. By W. E. Tate, F.R.Hist.S.

Pp. xxv + 215 Maps. Thoroton Society: Record Series, Vol. V. (Nottingham: Thoroton Society, Bromley House, Angel Row. 1935.)

The compiler of this volume has spent a number of years studying the progress of land enclosure in Nottinghamshire, and this volume contains summaries of the available information as to the methods by which application was made for enclosures and by which the physical facts of enclosures were carried out. The whole is illustrated by maps and a foreword by the general editor of the series, and a preface and introduction by the author.

The information provided supplements very extensively, as far as Nottingham is concerned, that contained in general works dealing with enclosures in the country as a whole, and will provide, as Mr. Tate hopes, a mine in which future scholars can delve to formulate their opinions on the many points of controversy which still exist regarding the merits of enclosure and the methods which were adopted to carry it out. Both the author and the general editor clearly hold emphatic opinions on these subjects and not without justification in the light of the documentary evidence presented. These opinions will be combated in some quarters, but on the whole, perhaps the general trend of modern opinion amongst economic historians is on their side. It is beginning to be believed that far less legal injustice was involved in the parliamentary enclosures than was formerly held, and that the marked advantages from a practical point of view which resulted far outweighed them, while any unfortunate results which may have accrued, affected only those who had no legal, but may have had some permissive, rights in the village community.

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Scientific Horticulture. Vol. V. Ed. R. T. Pearl, B.Sc., A.R.C.S., D.I.C. Pp. xxxii + 196, and 40 Figs. (Published by the Horticultural Education Association. Obtainable from the Editor, South-Eastern Agricultural College, Wye, Kent. 1937. Price 3s. 6d.)

The horticulturist who desires to keep in touch with recent developments in research and practice will find much to interest him in the new issue of this annual publication. The contributions cover a wide range of subjects, including articles on commercial horticulture in Essex and Middlesex, manurial experiments on vegetable crops in Lancashire, the virus problem in relation to seed potato production in North Wales, aphid migration and distribution in relation to seed production, fruit growing in North Wales, recent American research in copper fungicides, root suffocation of fruit trees, the keeping qualities of apples in relation to their maturity when gathered, the pot-plant industry, timber for glass-house construction, the problem of bud dormancy, the temperature requirements of hyacinths, plant hormones and their possible importance in horticulture, the uses of peat in horticulture, soils and lawns. Mr. W. J. C. Lawrence, F.L.S., contributes an interesting account of "Twenty-five Years Research at the John Innes Horticultural Institution," of which he is Curator. The number concludes with progress reports of that institution and of the St. Ives Research Station, and reviews of recent books of horticultural interest.

Solon Robinson, Pioneer and Agriculturist. Selected Writings edited by H. A. Kellar. Vol. I, 1825-45. Pp. xxv + 582, and 11 Figs. Vol. II, 1846-51. Pp. xvii + 556, and 13 Figs. (Indianapolis: Indiana Historical Bureau, 140 N. Senate Avenue. 1936.)

The publication of historical sources in America is becoming popular, and the various series which have been started show promise of being exceedingly valuable for future students of farming history in the United States.

The story of farming there is so romantic that it has not seemed at all similar to our own history, but even in a continent where pioneers were gradually extending the frontier, there was a need for leadership. The history of the leaders is usually an indication of the history of the communities in which they flourish, although the general members of these communities usually follow their progress at a slower rate. Solon Robinson was, in the truest sense of the word, a pioneer. He was descended from the Pilgrim Fathers themselves, and he was born in 1803. His life was as varied as that of most Americans who went West, but in another sense it was stable with the stability of a farmer, although he had the ingrained American habit of moving on. He tried many things, farming, store-keeping and country newspaper work, and he wrote extensively about agriculture. He travelled extensively throughout the parts of the States inhabited by Europeans in his time, and he recorded his impressions in the public press as well as in his personal letters. From 1852 to 1868 he lived in New York, where he devoted himself to writing stories as well as works on agriculture. In 1868 his poor health led him to resign his position as agricultural editor of *The New York Tribune* and to retire to Jacksonville in Florida, where he continued his activities on behalf of improved agriculture in his country. The collection of documents which is presented by Mr. Herbert Anthony Kellar in these volumes covers the period from 1825 to 1851, and a perusal of them will show how wide were the interests of the intelligent pioneer in the early half of the nineteenth century.

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Vegetable Crops for Market. By A. H. Hoare. Foreword by Sir William Lobjoit, O.B.E., V.M.H., J.P. Pp. 198 and 36 Figs. (London: Crosby, Lockwood & Son., Ltd. 1937. Price 7s. 6d.)

The author commences by giving a survey of vegetable production and points out that intensive production on market garden lines, once the outstanding feature of the industry, has now largely given way to extensive production by farmers, either on mixed farms or on very large holdings almost entirely cultivated with machinery.

The principles of manuring are explained from the angle that in the production of vegetable crops the use of a complete fertilizer, such as the 1-2-1 analysis ratio, is nearly always justified, though some variation with particular soils and crops is stressed. Fertilizers, however, do not contribute to the humus contents of the soil and all land devoted to vegetable growing will sooner or later require applications of dung, or its equivalent.

Tillage by modern motor implements is said to be efficient and brings about a considerable reduction in production costs. Good seed is regarded as of supreme importance and a chapter is included on seeds and plant breeding.

In the remaining chapters the various types of vegetables, salads and herbs suitable for market, together with methods of production, are described in detail. Finally, there is a chapter devoted to the production of early and forced crops in glass frames and cloches. There are numerous photographs—many of which are excellent. The book should be of real value to horticultural students and should serve as a useful guide to commercial growers.

Comment on Soigne son Jardin (*How to Cultivate the Garden*). By G. Truffaut. 7th Edition. Pp. 478 and 217 Figs. (Versailles: Georges Truffaut, 90 Avenue de Paris. 1937. Price 10 frs)

The well-known nurseries of Georges Truffaut at Versailles have for many years published a volume on gardening, which has now reached its seventh edition. The book, which is copiously illustrated with photographs and sketches, deals very fully with the garden of the amateur. The section on the vegetable garden contains a brief account of each vegetable, and forms an excellent exposition of the subject. The chapter on the fruit garden elaborates the method for training the wonderful pyramids that are common in the private gardens of France. Flowers are dealt with extensively, especially rose trees and flowering shrubs. Gardening under glass is mentioned, whilst finally the book gives a long account of the enemies of plants. Those who read French and are interested in gardening as carried out by our neighbours across the Channel will find this book extremely useful.

Jahresbericht für Agrikultur-Chemie (*Annual Report on Agricultural Chemistry*). 4th Series, Vol. XVI. Edited by Dr. F. Moch. Pp. 538. (Berlin: Paul Parey, 28 Hedemannstrasse, S.W.11. 1936. Price Rm. 86.)

With the rapid growth of agricultural research in the years immediately following the Great War, it became necessary, in order that the agricultural research worker should be kept in touch with the results of other investigators in the same field of inquiry, to begin the publication of journals devoted entirely to short abstracts of research papers appearing in scientific-agricultural periodicals in all parts of the world. The agricultural investigator does not need to be reminded of the useful role that these journals play in his daily activities, since through their agency he is

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enabled to ascertain without difficulty the progress that has been made in any branch of agricultural research in which he may be interested.

Although many of these journals of abstracts have made their appearance since the Great War, there are one or two classic instances where the original publications date back to the middle of the last century. Such a case is the German journal under review, which deals with progress in the domain of agricultural chemistry. The first number was published by Dr. R. Hoffmann as long ago as 1858, and the present annual report is the seventy-sixth of the series!

As an instance of the vast amount of work involved in the production of these reports, it may be pointed out that although the present volume is dated 1936, it actually deals with the results of research published in 1933. It is scarcely an exaggeration to assert that every paper dealing with original research in agricultural chemistry, and published during that year in no matter what scientific journal in any part of the world, is listed, with full references, in this volume. Adequate summaries of a very large number of these papers are also given.

The report is divided into the following main sections: (i) crop production; (ii) animal production; (iii) technical processes connected with agriculture; (iv) analytical methods and experimental technique. Each section in its turn is divided into numerous sub-sections, and by this means the entire field of agricultural-chemical progress during 1933 is surveyed with the utmost thoroughness.

The subject treatment is necessarily concise and severe, and it is perhaps desirable to point out that the work is by no means intended to provide easy reading for the casual student of agriculture. It is on the shelves of the research institute libraries that this and similar reports will find a suitable resting place.

The Feeding of Crops and Stock: Part II, Soils and Fertilizers. 2nd Edition. By Sir A. D. Hall, K.C.B., F.R.S. Pp. x + 122, 9 Figs. and 5 Tables. (London: John Murray. 1937. Price 3s. 6d.)

"It has been my endeavour," says the author, "to leave out all that is unessential to the practical farmer and gardener or that requires a knowledge of chemistry to be intelligible. Little is said as to the origin of soils, nothing about the sources and methods of manufacture of fertilizers . . . but the farmer and the gardener, who have to use soils and fertilizers, will here find a reasoned basis for their practice, and the student at a farm institute, and the young gardener who is preparing himself for the national examinations in agriculture will find as much science as matters, though possibly examiners with their fondness for irrelevant bookwork will demand more."

No writer is more competent than he to achieve this aim, were it attainable, but we venture to think that with all his skill Sir Daniel Hall has not quite solved the problem of making applied chemistry and physics really intelligible to the farmer unversed in the very elements of these sciences. One may sympathize heartily with his jibe at the examiner, and commend his book most warmly to the farm institute students and others whose reading can be supervised and interpreted by a teacher, but what will the average "practical farmer," ignorant of chemistry and its "jargon," make of statements such as (p. 19) "Chemically, the finer clay particles are complex substances in which silicates of alumina are combined with bases"? Does the word "base" convey any real meaning to his mind? Does he even understand what a "wash-bottle" (p. 65) is? After all, it is only a modicum of chemical knowledge, easily imparted in simple language, that the farmer requires in order to obtain a broad

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understanding of the chemical phenomena with which so much of his practice is concerned. One introductory chapter, or at most two, giving a simple exposition of the chemical conception of the nature of matter, and of chemical combination and interaction, would go far to ease the task of the farmer reader.

This volume is part of the well-known complete work that hitherto has been issued in one complete volume. It retains the basic features of the original edition, but in details has been thoroughly revised and modernized. Its science is practical and its practice teems with valuable information. It ought to be on the desk of every farmer who is alive to his obligation to make the most efficient use of his facilities, and in the hands of every young farmer who is preparing to assume this obligation.

Soil Conditions and Plant Growth. 7th Edition. By Sir E. John Russell, D.Sc., F.R.S. Pp. viii + 655, 65 Figs. and 108 Tables. (London: Longmans, Green & Co. 1937. Price 21s.)

This classic monograph was first issued in 1912, so that the present issue ranks as a Silver Jubilee edition. Its steady expansion in size from a modest volume of about 180 pages to its present rather awesome dimensions reflects faithfully the remarkable expansion of activity in research on soil and kindred problems during the quarter century of its history. A "curtailed" bibliography of some 400 items and an author index of some 1,400 names implement the picture of this expansion, and testify to the monumental labours of compilation throughout the years that have brought the work to its present form. Its rank as a classic has long received world-wide recognition, and the issue of a new edition must always rank as an event of major importance in the progress of soil science.

Despite this ever-increasing mass of material to be digested and absorbed, the original purpose of providing a book to be read rather than probed for information has been preserved to a degree that is rare in scientific works of reference. This must have been greatly facilitated by the innumerable personal contacts that the author has established with research workers in all parts of the world, which impart a savour of first-hand knowledge to his reviews of their work.

This new edition is no mere reprint of previous editions with supplementary matter, but incorporates changes so considerable that much of the book has had to be rewritten. Were there degrees of indispensability it might well be described as even more indispensable than ever to the research worker, the teacher and the aspiring student.

The British Goat Society's Yearbook for 1937. Pp. 188 and 60 Figs. (Compiled and issued by the Secretary, H. E. Jeffery, Roydon Road, Diss, Norfolk. Price 1s. 6d.)

Nearly 60 years have elapsed since the British Goat Society entered upon its mission of educating the public and popularizing the goat, and during the past 17 years it has been ably assisted in its difficult task by this annual publication. The present issue opens with an interesting account of the early days of the Society, whose founder, Mr. H. S. Holmes Pegler, still serves in the capacity of Honorary Treasurer. Practically every aspect of the subject receives attention; and excellent illustrations, statistical tables, hints on butter and cheese-making, and other data combine to make this a useful publication for all who are concerned with goats.

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Progress in the Transport and Storage of Foodstuffs

The work of the Food Investigation Board of the Department of Scientific and Industrial Research, whose Annual Report* for 1936 has just been published, is carried out in the interests of the general body of consumers in this country, and is directed to reducing waste and improving the variety and quality of foodstuffs generally available, by the application of scientific knowledge to the problems of transport and storage.

Possibility of Increase of Home Production of Pears. One of the most important achievements of the work of the Department on the storage of fruit has been the development of gas-storage. In this method the atmosphere of the store is altered to contain more carbon dioxide, the gas breathed out by the fruit and by human beings alike, and less oxygen, the correct proportions for any variety of fruit being carefully determined by experiment. The latest work on the gas-storage of pears seems to indicate that there is scope for a considerable increase in the home production of pears, for which technical information, both as regards production and storage, is now available. "It appears," the Board state, "from the results of the investigations carried out at the Ditton Laboratory during the past few years with the *Conférence* and *Williams' Bon Chrétien* varieties, that the pear responds even more favourably than the apple to gas-storage. These two varieties, at least, can be gas-stored most successfully for several months. After removal from gas-storage, the fruit ripens more slowly, and therefore allows more time for marketing, than fruit that has not been stored in this way. The production of pears in the United Kingdom has been regarded by growers as a specialized and limited activity; and some years ago, when inquiries were made as to the desirability of investigating methods for storing pears for long periods, it was found that the climatic conditions

* *Report of the Food Investigation Board for the Year 1936.* Published by H.M. Stationery Office, 3s. 6d. net.

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were unsuitable, except in certain localities. To-day, as a result of recent progress in horticultural research, a more hopeful view can, it is believed, be entertained of the cultural side of the industry. The annual value of the pears eaten in the United Kingdom is approximately £2,000,000, and the position as regards production and consumption may be briefly summarized as follows: In 1934—a good year from the growers' point of view—home production was 413,000 cwt., equivalent to 29 per cent. of the consumption. In 1935—a poor year—the quantity grown was 191,000 cwt., or approximately 13 per cent. of the consumption."

Storage of Plums. The problem of successfully storing Victoria plums for a short period is also one of considerable importance to the grower and distributor. A comprehensive series of experiments, commenced in the past season, has shown that, at 32°-34° F., a life of 3-4 weeks may be expected. Higher temperatures accelerate an abnormal softening of the fruit, and are only suitable for storage for a few days. Close attention must be paid to the degree of ripeness at picking if good quality is to be attained during ripening after storage. If the fruit is picked too green and hard, the flesh becomes soft and jellied at an early stage, especially at 40° F., and though a temperature of 32°-34° F. holds the change in check to some extent, really good quality cannot be attained. Fruit that was sufficiently mature when picked ripens well after cold storage at any temperature from 50° F. upwards; if the fruit was immature when picked, a great improvement in colour, and some improvement in quality, can be secured by ripening it at 70° F.

Relationship between Production and Storage Research. The Board comments on the relationship between the problems of production and those of transport and storage, and other post-production processes. "It is obvious," the Report states, "that where the agricultural product is to be stored or to receive other special treatment, production and research on production must have that end in view. For instance, the storage of fruit and eggs and the manufacture of bacon from pork clearly introduce new considerations into production that may have an important effect on the course which production takes. Producers, therefore, and those responsible for research on production require a specification towards which to work, and the preparation of that specification becomes

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our task. We do not suggest that research has gone far enough to make such specifications yet possible to any great extent. Nevertheless, it is already possible in some measure to specify, in scientific terms, what is required of the producer in an apple for storage, in a fish for smoking and in a pig for the manufacture of bacon; and as research progresses and the body of scientific knowledge grows, we may confidently anticipate that the specifications will steadily increase in scope and accuracy. Moreover, it is also our task to examine the product in terms of the specification, so that the producer and his scientific advisers may learn, from time to time, how far his efforts to improve production are meeting with success."

Bacon and Hams. "It is clear," the Report continues, "that constant and intimate co-operation between, on the one hand, the Agricultural Research Council and the Departments of Agriculture, who are concerned with production, and ourselves, on the other hand, is essential to progress over a large part of the range of home agricultural products." In this respect nothing is lacking to ensure success. There is, perhaps, no better example than that afforded by bacon. In collaboration with the research institutions represented on the Pig Husbandry Committee of the Ministry of Agriculture and Fisheries, experiments are being carried out on the effect of the breed, growth and feeding of the pig on the quality of the carcass. In addition, investigations on a large scale are being carried out for the Bacon Development Board, on the effect of transport of the pig on the weight of the carcass, and for the Pigs Marketing Board of Northern Ireland, on the differences between the carcasses of pigs killed on the farm and in the factory; both Boards are making substantial payments towards the cost of the work. In the course of the year a total of over 800 carcasses has been examined; this has been no light task for the small staff concerned, and is in itself testimony of close collaboration and good organization.

Eggs and Poultry. Among its other work on the storage of eggs, the quality of eggs stored at 0° C. in atmospheres containing different concentrations of carbon dioxide is being investigated by candling, by tests for palatability, and by the usual chemical and physical tests for the white and yolk. The results so far confirm that an atmosphere containing 2½ per cent. of carbon dioxide improves the quality of the egg, notably of the yolk. Atmospheres containing high concentrations of

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carbon dioxide, in the range 60-100 per cent., affect the quality of eggs uniformly, the yolks being firmer and the whites markedly more liquid than in eggs stored in air. Eggs have been stored in saturated atmospheres within this range for eight months without spoilage by mould or bacteria.

It has been known for some years that eggs retain their fertility longest if they are stored at a temperature of 10° to 12° C. Experiments during the past year have indicated that, at 10° C., the period of fertility can be still further prolonged if the atmosphere contains $2\frac{1}{2}$ -5 per cent. of carbon dioxide.

The Report records an interesting small trial on the storage of frozen poultry packed in aluminium foil covered on both sides with waxed paper. Some Sussex cockerels were stored for five months at -10° C. in this way. The birds were thawed down, cooked and eaten by several people, who without exception found them excellent in every way, and indistinguishable from fresh chickens.

Vegetables. An investigation of the conditions in clamps of potatoes has revealed considerable variation in temperature, sugar-content and sprouting, both between different points in a single clamp and between clamps of different construction. The evidence suggests that improved construction of the clamps may result in better storage of potatoes intended for the manufacture of crisps, and possibly also in improved quality in potatoes held for general domestic use.

Trials of the storage of broccoli have been made with two varieties. A temperature of 32° F. proved best, since higher temperatures reduced the life of the vegetable by accelerating the growth of moulds and yellowing of the leaves. A high humidity is necessary to prevent excessive wilting of the leaves, which would be detrimental to the appearance of broccoli in marketing. At 32° F. and with air of approximately 96 per cent. relative humidity freely circulating in the store, the broccoli kept for three weeks, with three to four days subsequently available for marketing before deterioration set in.

Land Fertility Committee

In accordance with Section 2 of the Agriculture Act, 1937, which received the Royal Assent on July 30, 1937, the Minister of Agriculture and Fisheries, the Secretary of State for Scotland and the Secretary of State for Home Affairs have approved the

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appointment of the following to be the Land Fertility Committee for the United Kingdom:—

Lord Cranworth, M.C. (Chairman).

Sir William Young, K.B.E., C.B.

Sir John Milne Home, Kt., D.L., J.P.

Mr. D. W. Coates, C.B.E., M.A., LL.B., F.C.A.

Mr. John Pike, O.B.E.

The Secretary of the Committee is Mr. Wynn Thomas, O.B.E.

The Committee will exercise such functions as may be assigned to it under the Land Fertility Scheme to be prepared by the Ministers with the approval of the Treasury, with the object of assisting farmers to increase the fertility of their land by applying to it lime and basic slag.

Details of the Scheme and the date on which it will come into operation will be announced as soon as possible.

Tar Marking of Sheep

It appears that some farmers still continue the undesirable practice of tar-marking their sheep, and in view of the harm done to the fleece, the Ministry of Agriculture has again issued a warning against the method. Where tar has been used, great difficulties are caused to the wool manufacturer in handling the fleece; and there is no necessity to use tar, because equally satisfactory and durable marking materials are available.

Two new marking materials have been produced as a result of experimental work carried out by the Wool Industries Research Association, and their efficiency from the farmer's standpoint has been fully proved by tests both at home and abroad. The two preparations differ, but that recommended for use in this country is composed as follows:—

<i>Parts by Weight</i>						
Wool fat	..	..	..	..	..	150
Carnauba wax	..	..	..	..	..	10
Barytes	..	..	..	..	..	70
Colour	..	..	..	..	..	17.5
White spirit to consistency.						

If this material is used, no difficulty is experienced by the manufacturer when he comes to deal with the fleece, and it is, therefore, very desirable that it should be substituted for tar on farms where that substance is still used.

NOTES FOR THE MONTH

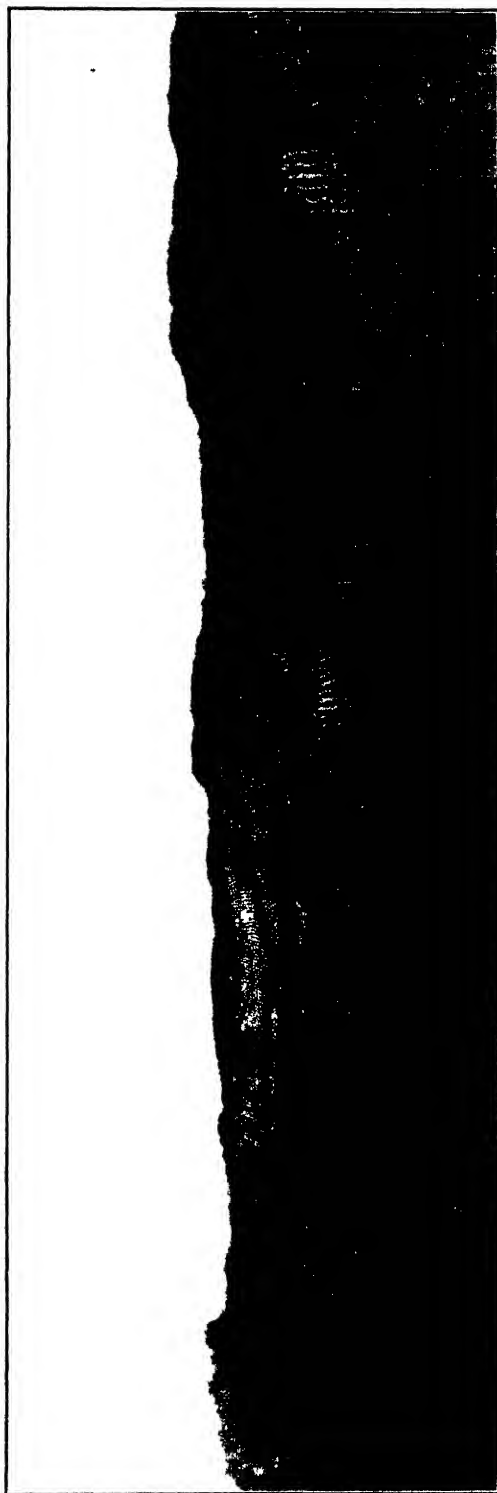
Guaranteed fluid made to the formulae of the Research Association can only be obtained from duly authorized agents, and farmers who have been using tar, but desire now to improve the quality of their wool output, should apply, for any further information they want and for the names of supply agents, to the Wool Industries Research Association, Torridon, Headingley, Leeds.

A Dutch Method of Sand Dune Reclamation

The following note has been communicated by Mr. H. Mortimer Batten:—

A phase of sand dune reclamation on the island of Shouwen, Holland, is shown in the accompanying view, which illustrates part of an area of some six square miles of sand, the reclaiming of this being undertaken as an experiment by an enthusiast whose real work was the poldering of marshes. The "planting" is not marram grass, as used by the Forestry Commission at Culbin, Morayshire, and elsewhere,* but dead reeds stuck into the ground purely for stabilization. Meanwhile pine saplings are reared from seed in a hedged nursery nearby, and raised by the thousand. When these saplings have attained a height of six inches, they are planted out between the rows of reeds. A square kilometre is planted each year, and the loss of trees is stated to be very small. Marram is not used at all, and this work of reclamation is the best I have yet seen. Much patient experiment was necessitated, and a good deal of disappointment experienced, ere the best methods of procedure were arrived at, one secret being the planting of the trees almost from the seed pan. It was found that two-year and older saplings died, especially in the early spring.

* The Ministry understands that the work of the Forestry Commission at Culbin, and at Pembrey, Carmarthenshire, aims at afforestation with the assistance of marram grass, i e, not merely the protection of plantations but the reclamation of the land for the production of timber. In this matter, much may depend on local conditions. For places not subject to high winds and occasional squalls, dead reeds might suffice, or they might be successful on small sheltered localities. On the other hand, if buried by drifting sand, the dead reeds will cease to function, whereas marram grass or similar growth, when buried, keeps alive and pushes its way through the covering sand in course of time. The Forestry Commission has found that pine seedlings, either one year or two years old, generally prove the most suitable type for planting.



Sand Dune Reclamation at the Island of Schouwen



The Wren at Nest

(Photograph copyright G K Yeates)

NOTES FOR THE MONTH

Interesting Birds: (7) The Wren

The wren, a tiny bird whose appearance and demeanour have aptly been described as "perky," is a general favourite with bird lovers. Its short, upturned tail and its habit of creeping mouse-like among low hedges and undergrowth render its identification an easy matter. It is also a very beneficial bird, living mainly on insects in various stages and destroying large numbers of garden pests. Its song is musical and clear, and of a surprising volume for so small a bird.

The wren's domed and cleverly constructed nest is found in all sorts of odd corners, and, like the robin, this bird seems to have a special aptitude for adapting its nest to the peculiarities of any situation in which it chooses to build. Its eggs, which may number from five to seven, or even more, are white, lightly speckled with red. Unspotted eggs are, however, not uncommon. Care should always be taken when examining a wren's nest, as the bird is apt to desert it on very little provocation. One of the most interesting characteristics of the wren is its habit of constructing numbers of extra nests in a single season. These spare nests are almost invariably unlined and are sometimes known as "cock" nests, it being believed by some people that they are made by cock birds only. This, however, is erroneous. There is evidence that both sexes join in building them. There is also conclusive evidence that they are used by the wrens as winter shelters.

Both farmer and gardener should welcome and protect the wren, which is a likeable and useful bird.

A New Method for Harvesting Roots

This method, known as the Ultuna Method, comes from Sweden and consists of first cutting off the tops, while the roots are still in the ground, and then lifting the roots by means of a "sledge," pulled by horses. This method enables the crop to be harvested more quickly and at less cost.

The implement used for cutting off the tops came originally from Germany, and is, in reality, a large flat hoe, with a length of heavy gauge wire bent into a semi-circle from each side of the blade and secured to the handle by means of a staple, with a piece of soft wire attached crosswise and fastened to the foot of the handle, in the middle (Fig. 1). The idea is that this wire will catch the tops, when cut, so that they may be cast to any desired spot, to facilitate handling. The work of cutting is both lighter and easier if the hoe has a relatively

NOTES FOR THE MONTH

long handle and an angle of about 32° between handle and blade.

For cutting, blocks of ten rows are taken at a time, 2 rows being allotted to each man. The tops from each block are all cast into the middle, i.e., on to rows V. and VI. (Fig. 2), so that these rows are cut first, then rows III and IV. and VII. and VIII., followed by rows I. and II. and IX. and X. It has not been found practical, however, for one man to cut more than 2 rows at a time.

A type of skeleton sledge, with shares attached on the inside and drawn by two horses—on heavy soil—uproots the crop. This "Root Sledge," as may be seen from Fig. 3, is of simple design and solid construction and may be made for approximately £2. It covers 2 rows of roots and is held firmly down by the weight of the man, driving the horses, standing on top of it (Fig 4). As the Root Sledge moves along, the roots are dislodged by the shares and left behind in one line by the spring steels. It is then a simple matter to throw them on to a cart.

The time taken in harvesting roots by different methods has been worked out by Jordbrukstekniska Föreningen, Ultuna, by whose courtesy these illustrations are reproduced, and give an indication of the saving in time.

Time taken to harvest an acre of roots by various methods :

Conditions : Variety of crop : Swedes,
Yield per acre : 30 tons,
Approx. length of rows : 200 yards,
Distance between rows : approx. 20 inches,
Carting : about ten loads of 10 cwt. each,
Labour : 4 men, 2 prs. horses.

					Actual Working Time Hours	
Hand Methods :					<i>Men</i>	<i>Horses</i>
Method A—clamping in the field :						
Pulling, cutting off tops and clamping	..	..	..	..	40	—
Carting (8·2 loads per hour)	..	..	..	..	25	25
Total	..	..	..	..	65	25
Method B—carting away at once :						
Pulling and topping	..	..	..	..	27·5	—
Carting ..	..	..	..	..	33·5	33·5
Total	..	..	..	..	61·0	33·5
Ultuna Method :						
Topping by hoe	..	..	..	..	8·25	—
Uprooting with Root Sledge	..	..	..	..	1·75	3·5
Carting (7 loads per hour)	..	..	..	..	29·00	29·00
Total	..	..	..	..	39·00	32·50

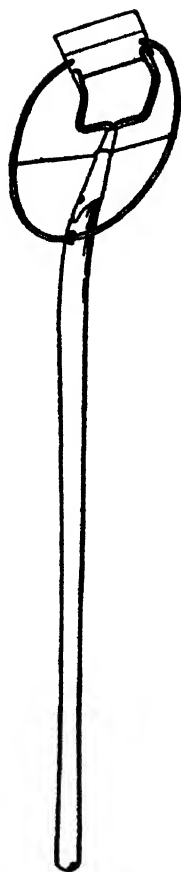


FIG. 1.—Special Implement for Cutting Root Tops.

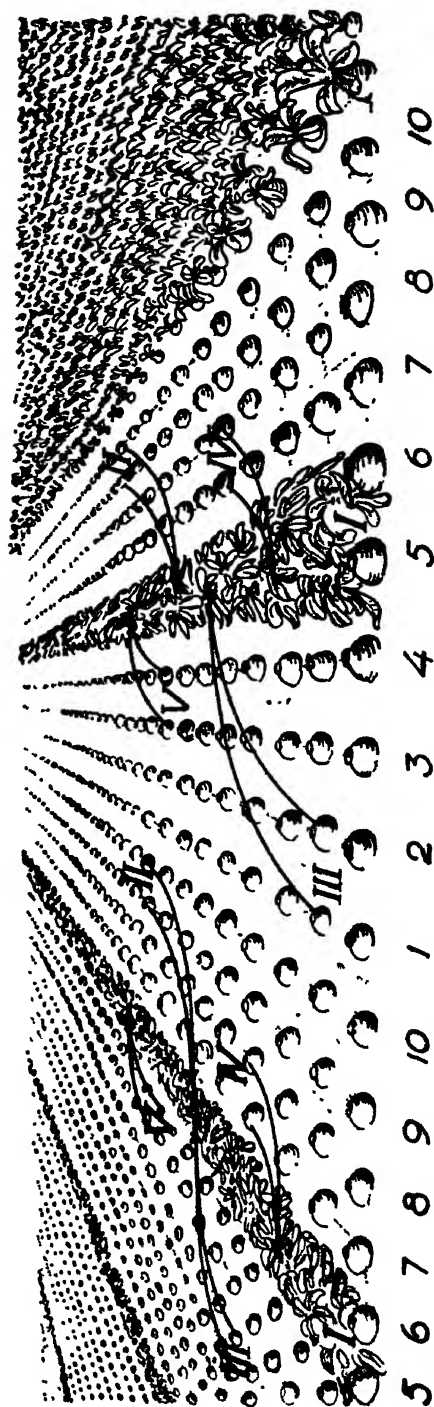


FIG. 2.—System of Cutting Root Tops.

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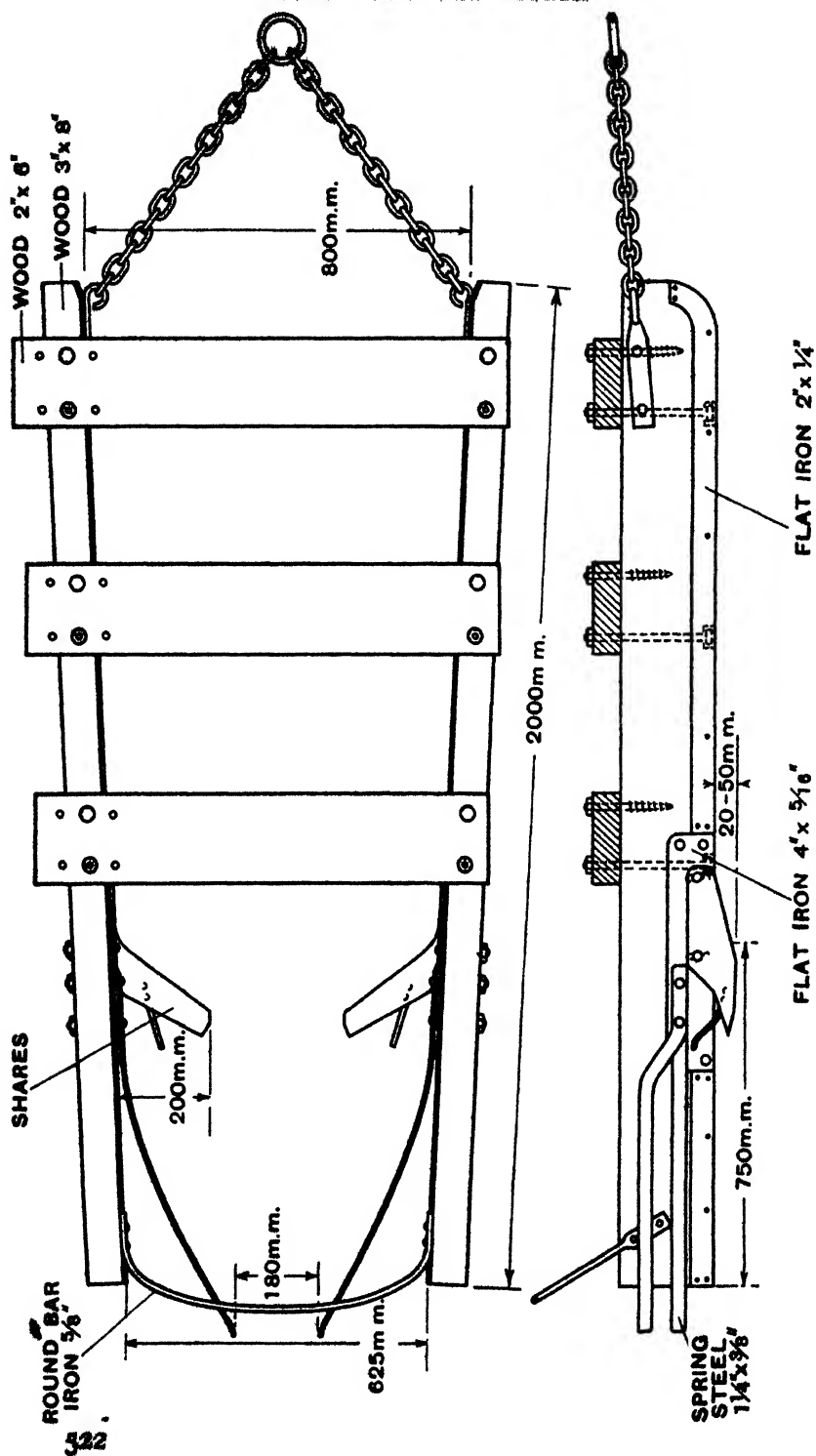
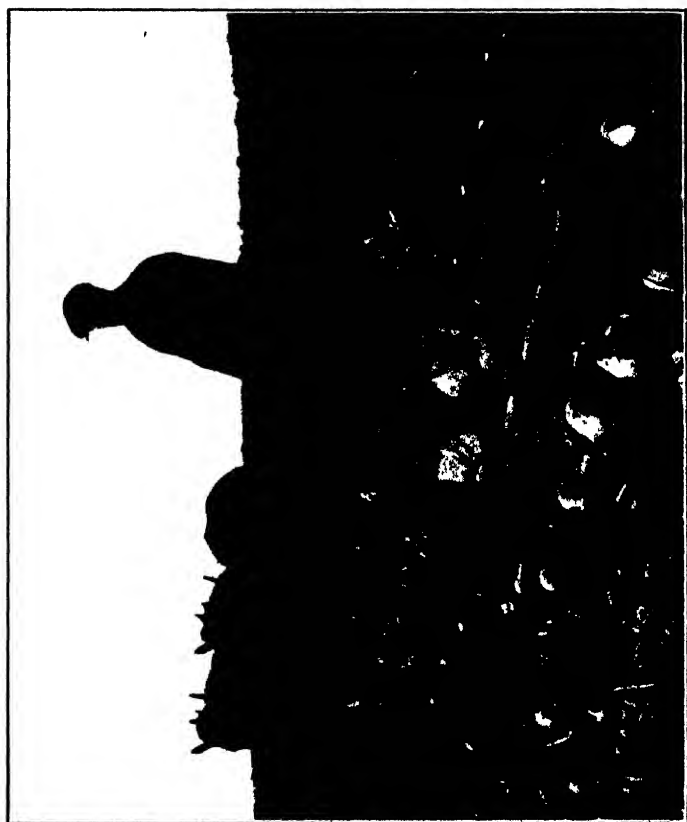


FIG 3 —Plan and Section of Special Type of Root Sledge.



• FIG 4 Method of using Root Sledge.

NOTES FOR THE MONTH

It will be noticed that the horse labour for all methods is about the same, while the time saved in manual labour by the Ultuna method is considerable—in one instance nearly half, and in the second a matter of 22 hours per acre of roots harvested.

This apparatus is successfully used in Sweden for lifting all round types of roots, including "swedes," round types of real turnips and mangolds of the type that grow with the greater part of their root above the ground. For lifting mangolds, it is necessary to adjust the iron shares to cut deeper into the soil. Mangold leaves, however, do not lend themselves so readily to cutting by the method described, owing to their spreading habit, while their roots do not lift as cleanly as those of turnips, owing to their numerous side rootlets.

The method appears to work equally well on both light and heavy soils. Quickness is its chief commendation, any time saved at such a busy season of the year being precious, quite apart from the saving in production costs.

Midland College Poultry Conference, 1937

The fourteenth Annual Poultry Conference will be held at the Midland Agricultural College, Sutton Bonington, Loughborough, on Tuesday, September 21, 1937, under the presidency of Mr. E. Hugh Hudson, Chairman of the Southern Counties Poultry Society. After the formal opening at 10.45 a.m., the morning session will be occupied with Mr. G. Macrea Robertson's paper on "Intensive Turkey Production," on which the discussion will be opened by Mr. R. B. Shaw; and Mr. I. W. Rhys' review of "Notable Commercial Poultry Farming Enterprises," illustrated by lantern slides.

The afternoon session will commence at 2 o'clock with the presentation of the College Challenge Cup to the winner of the Inter-County Laying Trials, and of awards to winners of the Notts. Laying Trials. Mr. J. Wyllie will read a paper on "The Economic Outlook for Poultry Farming," the discussion to be opened by Mr. J. R. Bond; and Mr. W. M. Golden will deal with "Methods of Feeding," the discussion to be opened by Mr. A. J. Macdonald, Deputy Director of the National Poultry Institute. The papers will be brief, to allow ample time for discussion. Tea at 4.30 p.m. will be followed by an inspection of the College poultry plant and departments.

Intending visitors may obtain full particulars of the Confer-

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ence, including charges for board, lodging and refreshments, from the Principal of the College, which is 8 minutes' walk from Kegworth (L.M.S.) railway station.

Agricultural Research Scholarships and Studentships

On the recommendation of the Agricultural Research Council, the Ministry has awarded the following post-graduate scholarships and studentships tenable from October 1:—

AGRICULTURAL RESEARCH SCHOLARSHIPS:

Three-year Scholarships:

P. J. Faulks	..	..	..	Plant Physiology.
F. H. Malpress				Nutritional Chemistry.
J. Wilson	..			Plant Genetics.

Two-year Scholarship

R. S. Russell				Plant Physiology.
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One-year Scholarship:

G. H. L. Dicker	Entomology.
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STUDENTSHIPS FOR RESEARCH IN ANIMAL HEALTH:

Three-year Studentships:

F. D. Asplin	Poultry Diseases.
Miss K. M. Massey	..	..	..	Poultry Diseases.

These awards are made with the object of training research workers, and thus advancing agricultural science and scientific studies bearing on animal health.

GOVERNMENT AGRICULTURAL POLICY

On May 27, the Minister of Agriculture made a statement in the House of Commons outlining certain Government proposals for agriculture. These proposals were embodied in the Agriculture Act, 1937, which received the Royal Assent on July 30, and the nature of which may best be gathered from the full title of the Act, namely:—
“ An Act to assist farmers to increase the fertility of their land; to provide for securing farmers against any substantial fall in the price of oats and barley, and to raise the limit of the quantity of wheat in respect of which deficiency payments under the Wheat Act, 1932, may be made at the full rate; to make further grants for land drainage; to promote the eradication of diseases of animals and poultry, and with that object to establish a national service of veterinary inspectors; and for purposes connected with the matters aforesaid.”

Two further important statements regarding agricultural policy have since been made. These concern milk, pigs and bacon, and are reproduced below :

Milk

1. The Government have carefully considered the position of the dairying industry from the points of view both of producers and of others engaged in the industry and of consumers. They have had before them the Report of the Reorganization Commission for Milk, other authoritative Reports bearing on the industry and also the views of representative organizations, all of which have been of the greatest assistance. They have also taken into consideration the recent outcome of the application made, on behalf of milk producers, to the Import Duties Advisory Committee, for increased duties on butter and cheese.*

2. The Government desire to see the dairying industry of this country self-supporting and profitable and their policy for this industry, as for other branches of agriculture, is to ensure the maximum supplies for the consumer at fair prices

* An announcement on this subject was made by the Financial Secretary to the Treasury in reply to a Parliamentary question on July 28, 1937.

AGRICULTURAL POLICY

consistent with reasonable remuneration for the producer. They believe that the only sure foundation for the prosperity of the industry is an increased consumption of liquid milk. An essential step towards this objective is to establish public confidence in the cleanliness and purity of the milk supply and thereby to quicken demand for what is one of the most valuable of human foods. It is with this object in view, and in order to bring to full achievement the efforts that dairy farmers have themselves been making to improve the quality of their product, that they propose to invite Parliament to provide additional Exchequer assistance on the lines set out below.

3. The Government also propose to continue and extend their policy of promoting the increased consumption of milk among those sections of the population for whom it is of particular value.

4. With the approval of Parliament, the dairy farmers of Great Britain a few years ago set up Milk Marketing Boards under the Agricultural Marketing Acts. In this way, they were able to cope with a price situation that had been steadily growing unstable and to avert a collapse which would have spread disaster through the countryside.

5. The industry, thus enabled by Parliament to attack its internal problems, was further assisted by a temporary Act called the Milk Act, 1934, the main provisions of which expired in 1936, which had a three-fold object: (i) to supplement the low receipts of the Milk Marketing Boards from the sale of milk for manufacture, (ii) to increase the consumption of liquid milk and (iii) to promote a purer milk supply. The first was of an emergency nature; the second and third indicated the lines of future policy. This measure has been extended once, and by the Milk (Amendment) Bill of this Session it is proposed to extend the main provisions for a further period until September 30, 1938.

6. It is still desirable to safeguard the industry against emergency conditions, but circumstances have altered to an extent that now enables the Government to lay relatively greater emphasis on measures designed to promote the increased consumption of liquid milk and the provision of a purer milk supply.

7. Under the Milk Act, 1934, the receipts of the Milk Marketing Boards from manufacturing milk were supplemented by a system of repayable Exchequer advances based on standard

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prices per gallon of milk used for manufacture. The Government now propose to safeguard the industry against the effect of any serious fall in the prices of butter and cheese below current levels, by means of a price-insurance plan under which Exchequer assistance will be payable, on a prescribed scale, to the Boards in respect of standard gallonages of milk used in factories for butter and cheese, and milk made into cheese on farms, in the event of the average prices of imported butter and cheese falling, over a period, below 100s. and 56s. per cwt. respectively. The present average prices of imported butter and cheese are of the order of 115s. and 72s. per cwt. respectively. The corresponding prices in February, 1934, when the Milk Act proposals were announced, were 71s. 6d. and 47s. 6d. per cwt. respectively.

8. The advances to the Milk Marketing Boards of Great Britain under the Milk Act, 1934, and subsequent legislation, involve the Boards in a contingent liability during a period ending September 30, 1940, to repay to the Exchequer an amount estimated at over £3,400,000. This liability only arises if cheese or butter prices rise to a certain level, and it is anticipated that the repayments which will have accrued by October 1, 1937, will amount to approximately £150,000. It is proposed to release the Milk Boards from any balance of this liability accruing after September 30, 1937.

9. In order to give the necessary momentum to the production of quality milks in Great Britain, the Government propose that Exchequer contributions should be made at diminishing rates, for a period of five years, towards the additional costs incurred in the production of milk of the Accredited standard, milk of the Tuberculin Tested standard and milk from Attested Herds. This assistance will be partly in the form of quality premiums additional to those now receivable by producers, but they will also be, in part, in relief of the contribution towards quality premiums which all producers in England and Wales make to-day under the Milk Marketing Scheme. It is proposed that the rates of the Exchequer contributions will be fixed for five years in the case of the Accredited and Tuberculin Tested schemes but that in the case of the Attested Herds scheme the rates should only be fixed for three years and that milk from attested herds shall be assisted in the fourth and fifth years at rates to be determined following a review of the position during the third year.

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10. The premium on Accredited milk sold by wholesale now payable from the pool funds of the Milk Marketing Board in England and Wales is at the rate of 1d. a gallon, the whole cost of which is borne by the pool; it is proposed that, for the five-year period beginning on October 1, 1938, this should be increased to 1½d. a gallon, of which the Exchequer contribution would be ¾d. for each of the first two years, ½d. for each of the third and fourth years and ¼d. for the fifth year, the balance each year to be borne by the pool. The proposed rate of premium of 1½d. per gallon should encourage a large and increasing number of producers to take up the production of milk of this standard.

11. As provided in the amendments of the English Milk Marketing Scheme which Parliament has recently approved, the Milk Marketing Board will pay a special quality premium on sales of Tuberculin Tested milk sold by wholesale, which will no longer be exempt from the Scheme. For the first two years of the five-year plan under these proposals, the premium will be at the rate of 1d. a gallon, towards which the Government propose that the Exchequer should contribute ½d. For each of the third, fourth and fifth years, it is proposed that the Exchequer shall contribute ¼d. a gallon and that the premium shall not be less than ¾d. a gallon.

12. Under the Agriculture Bill of this Session, financial assistance is provided to encourage the eradication of bovine tuberculosis by means of the Attested Herd Scheme. This assistance includes an Exchequer payment of 1d. a gallon on milk from Attested Herds, the Milk Boards being under a contingent obligation to assume this liability in due course. In order to accelerate the flow of pure milk under that Scheme, it is proposed for each of the first two years that the premium on sales by wholesale should be increased to 2d. a gallon, of which the Exchequer would contribute 1½d. and the pool would be required to contribute ½d. as soon as these proposals came into force. For the third year, it is proposed that the premium that the Boards shall be required to pay shall not be less than 1¾d. a gallon, towards which the Exchequer will contribute 1½d. a gallon. As stated above the rates of assistance for the fourth and fifth years will be determined later. In view of these new liabilities, it is proposed to release the Boards from the contingent obligation mentioned above.

13. The following Table shows the rates of premium which

AGRICULTURAL POLICY

the Boards will be required to pay in respect of the various categories of quality milks and the Exchequer contributions thereto:—

	Accredited Milk		T.T. Milk		Milk from Attested Herds	
	<i>Pool</i>	<i>Exchequer</i>	<i>Pool</i>	<i>Exchequer</i>	<i>Pool</i>	<i>Exchequer</i>
	<i>Premium</i>	<i>contribution</i>	<i>Premium</i>	<i>contribution</i>	<i>Premium</i>	<i>contribution</i>
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
1st year	1½	¾	1	½	2	1½
2nd year	1½	¾	1	½	2	1½
3rd year	1½	¾	¾	½	1½	1½
4th year	1½	¾	¾	½	—	—
5th year	1½	¾	¾	½	—	—

In view of the difficulty of estimating at this stage the effect of these proposals upon the development of the Attested Herds Scheme during the first three years, it is not proposed to fix the respective amounts of Pool Premiums and Exchequer Contributions for more than the period shown. Exchequer assistance will be given for the fourth and fifth years also; it is contemplated, however, that it will be on a diminishing scale, and as the amount can only be determined when the development of the scheme is known, it is proposed to leave this question to be reviewed during the third year in the light of the circumstances of the industry and the working of the scheme.

The producer of Tuberculin Tested milk will thus earn premiums amounting to 1½*d.* (accredited premium) plus 1*d.* (T.T. premium) equals 2½*d.* per gallon in the first two years and 1½*d.* plus ¾*d.* equals 2*d.* in the remaining three years, towards which the Exchequer will contribute:—

						<i>d.</i>
1st year	..	..	..	..	..	1½
2nd year	..	..	..	..	..	1½
3rd year	..	..	..	..	..	..
4th year	..	..	..	..	..	..
5th year	..	..	..	..	..	..

Similarly, the producer of Accredited Milk with an Attested Herd will earn premiums amounting in the first two years to 3½*d.* per gallon, and in the third year to 3*d.* per gallon, towards which the Exchequer will contribute:—

						<i>d.</i>
1st year	..	..	..	..	..	2½
2nd year	..	..	..	..	..	2½
3rd year	..	..	..	..	..	1½

14. The position of producer-retailers in England and Wales has been improved by the recent amendments to the Milk

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Marketing Scheme which have had the effect of placing their contributions on a new basis. In view of this, some modification of these proposals will be proposed in their case.

15. It is proposed to make corresponding provisions in relation to the production of quality milks in Scotland, but certain adjustments may be necessary to meet the special Scottish conditions.

16. The Committee on Animal Diseases of the Economic Advisory Council recommended that the introduction of some measure of compulsory pasteurization should no longer be deferred and the Government propose that, subject to certain conditions, any Local Authority shall be enabled to apply to the Minister of Health, or the Secretary of State for Scotland, for an Order making compulsory the efficient pasteurization of milk sold by retail in its area. These conditions are that no such Order shall come into operation within two years after it is made, that milk from tuberculin-tested herds and Sterilized Milk shall be exempt from its scope and that milk retailed from dairies where the milk is derived from a single herd shall be exempt for three years from the date of operation of the Order.

17. The Reorganization Commission for Milk, and other bodies that have examined the problem of milk distribution in recent years, have expressed the view that the present methods of distributing milk are in many respects capable of improvement. This appears to be generally accepted by those who speak on behalf of the distributive trade. Accordingly, the Government propose, in the legislation that will be necessary to carry out the present proposals, to include provisions to facilitate the improved organization of the distributive service.

18. It is proposed also to adopt the machinery of service schemes on the lines of those for which provision is made in the Livestock Industry Act of the present Session of Parliament, so as to enable the various sections of the industry to finance co-operatively services of common interest.

19. The Government propose that a permanent Milk Commission should be set up to keep under review the production, marketing and consumption of milk (including the effect of prices on demand) and to be of general assistance to the industry and to the Ministers concerned. The primary duties of the Commission will be concerned with the improvement of milk distribution and with conciliation and arbitration between the Milk Marketing Boards and the milk buyers in business

AGRICULTURAL POLICY

matters. Apart from this, it is not proposed to disturb the existing arrangements for the negotiation of contract terms and prices or the public safeguards provided, under statute, by the Consumers' Committees and the Committees of Investigation. The Government propose, however, to take steps to enable the views of consumers to be made available to the Milk Marketing Boards at an early stage in the contract negotiations.

The Commission will be required to present an annual report for submission to Parliament.

20. The Government regard the continuance of the scheme for the provision of cheap milk for school children as an essential feature of their proposals and they are confident that in this matter the co-operation of the industry will, as at present, be forthcoming. This scheme has now proved its merits, and has resulted in a large increase in the consumption of milk in schools. In making arrangements for its continuance, the Government will consider the need for minor modifications to meet difficulties which have arisen in its administration.

21. The Government attach not less importance to an increased consumption of milk by expectant and nursing mothers, and children under school age, and they will bring forward proposals for securing, in co-operation with the industry, a reduction in the price of liquid milk to local authorities for the purpose of their maternity and child welfare arrangements. Local authorities will thus be in a position to extend their present schemes under which milk is made available either free or at a reduced price as circumstances may require.

22. The Government commend the proposals as a whole as a policy which will provide for the dairying industry a basis for an increasing sale of milk in the liquid market, will secure cheap milk for those classes of consumers to whom it will be of particular value and will provide for consumers generally a permanent improvement in the cleanliness and purity of the milk supply. The proposals should lead to a reduction in the cost of distribution and, as the eradication of disease among dairy herds progresses, in the cost of production; they should lead to the enhancement of technical efficiency; and they will be a notable step towards the ultimate objective which must be to ensure that only clean and pure milk is offered for sale for liquid consumption.

AGRICULTURAL POLICY

Legislation to give effect to these proposals will be introduced as early as practicable next Session.

23. The Ministers concerned have deferred consideration of a scheme, submitted under the Agricultural Marketing Acts, for regulating the marketing of milk products. Subject to the wishes of the promoters in the light of these proposals, the Ministers concerned will be prepared to give this scheme further consideration.

24. The following statement shows the estimated cost of the Exchequer contributions to the Quality Premiums in each of the next five years :—

<i>Year</i>	<i>Exchequer Contributions to Quality Premiums (excluding expenditure under Part IV of the Agriculture Bill)</i>
<i>Oct.—Sept.</i>	<i>£</i>
1938–39	1,700,000
1939–40	1,962,000
1940–41	1,781,000
1941–42	1,425,000*
1942–43	800,000*

* Does not include assistance for Attested Herds for the 4th and 5th years—see paragraph 13.

Pigs and Bacon

On July 29, the Minister made the following statement :—

“ The Government have given careful consideration to the difficulties of the bacon industry, which appear to be attributable, in part, to the increase of pig-feeding costs and, in part, to the high costs of bacon manufacture in this country. They believe that if the industry were founded on a small number of efficient factories provided with adequate and regular supplies of pigs of good quality and conformation, sufficient economies could be secured in the cost of curing to enable the industry to be maintained during periods of high feeding costs.

The Government accordingly would be willing to propose that some assistance should be accorded to the industry over a sufficient period to enable the contract system for the supply of bacon pigs to be re-established if they were assured that the reorganization of the bacon factories would so proceed as to hold promise of a reduction in curing costs which would

AGRICULTURAL POLICY

enable both producers and curers to work at a profit. The Government desire to give further consideration, in consultation with the industry, to the nature of the changes that would be required and the form which they should take, with a view to laying detailed proposals before Parliament as early as possible.

Meanwhile the present arrangements for the regulation of imports will continue in force."

Since this announcement was made, the Minister has informed the Chairmen of the Pigs and Bacon Marketing Boards that he desires that the detailed plans for the reorganization of the bacon factories should be prepared in the closest consultation with the industry, and that his Department will accordingly initiate discussions early in September.

REARING YOUNG PIGS.—I

V. C. FISHWICK,

Pig Husbandry Research Station,

South-Eastern Agricultural College, Wye, Kent.

The foundation of a successful pig industry lies in the breeding herds, for unless healthy piglings of the right type can be reared economically, fattening must of necessity be a precarious business. Results obtained in the early work of this station, which were recorded in this JOURNAL for December, 1931,¹ indicated that whereas it was a more or less simple matter to rear young pigs during the summer months on the out-door system, comparatively inferior results were obtained indoors. Piglings reared in the open suffered less from scour, developed a better appetite, and made more rapid growth than did those confined to styes. During the winter months the mortality amongst indoor-reared piglings was apt to be unduly high. Subsequent work has been concentrated upon the study of the indoor system of management, and results obtained during the past year indicate that a method has been found that will reduce the incidence of some of the more serious troubles encountered in rearing young pigs under that system.

Scour, or diarrhoea, is a constant trouble amongst piglings. The term has been rather loosely used in recent years and there are some who look upon it as a disease. The more generally accepted use is here made of the term, e.g., as describing a symptom that is characteristic of a number of disorders. Every litter that has been reared at Wye has been observed to scour at some time during the nursing period. The cases may be divided for convenience into two classes: (1) Those that appear to be caused by minor digestive disturbances and respond to simple treatment such as dosing with lime water; these are subsequently referred to as "Simple Scour"; (2) Those in which the disorder has been symptomatic of disease, enteritis and anaemia being the two diseases that have been diagnosed.

It was observed in 1934 that certain litters of sucking pigs were more subject to scour when receiving a supplementary ration containing 12½ per cent. of foods having high protein

For references see p. 545.



FIG. 1 An Autumn Fitter of Group I



FIG. 2 An Autumn Fitter of Group II

REARING YOUNG PIGS—I

content, such as dried skim milk, fish meal and soya bean meal, than when they received a mixture containing only cereal meals and minerals. It therefore became desirable to obtain information regarding the value of the protein-rich foods as a constituent of the supplementary ration, and as a preliminary step in the investigation of that subject it was decided to study the growth of sucking pigs that received a supplementary ration consisting of cereal meals and minerals alone. Ration No. 4, Table I. (p. 537), was selected as a suitable mixture of cereal meals and minerals, and since 1934 all the sucking pigs have received that mixture. A comparatively high standard of growth has been obtained when the other factors in the feeding and management have been reasonably good. The following are the figures from one group of 36 litters reared in the year 1935-36:—

	Average Number of Pigs Weaned per Litter	Weight at Weaning	
		Average per Litter	Average per Pig
16 litters weaned, Sept 1935—Mar 1936 ..	8.8	<i>lb</i> 235	<i>lb</i> 26.7
20 litters weaned, April—Aug 1936 ..	10.3	291	28.2
Total 36 litters weaned, Sept 1935—Aug 1936	9.6	266 5	27.7

In the summer of 1935 it was observed that some piglings would drink water from the time they were two weeks old, and the idea of offering them water containing an antidote to simple scour occurred to the writer. A preliminary trial was made with barley water and it was found that piglings would drink that mixture more readily than plain water. This opened up another problem, which appeared to be more important than the work on the protein content of the supplementary ration, and the latter was therefore postponed for a year.

Anaemia has been a constant source of trouble amongst piglings reared indoors at this station, particularly during the autumn and winter months. Numerous preventive measures such as placing earth, ashes or a green turf in the pens had been tried. Such measures appeared to be successful with

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some litters but failed with others because the piglings showed no inclination to eat such materials regularly. Before the summer of 1935, no simple preventive measure had been discovered which could be relied upon to act consistently and was suitable for use under ordinary farming conditions. The knowledge that piglings would drink barley water from the time they were two or three weeks old opened up a new line of attack, as the addition of a soluble iron salt to barley water produced a mixture that was a preventive of anaemia, as well as of simple scour. This mixture is described as barley water-iron and an experiment was carried out between September, 1935, and September, 1936, to ascertain its value.

Parrish's food was used as the source of iron because it is appetising and much safer than the cheaper soluble iron salts. The quantity used was 1 dram per pig per day.

Barley water is made from barley meal and boiling water. The meal is mixed with water at the rate of 1 lb. per gallon. The mixture is stirred vigorously and subsequently allowed to stand and cool; by the time it is cool the solid portion has settled, forming a sediment at the bottom of a cloudy liquid. The latter is barley water and is decanted.

Barley water-iron is made by adding Parrish's food to barley water at the rate of 1 oz. of the former to each pint of the latter. Barley water ferments readily and it is not advisable to make up more than is required for use each day. At Wye the practice is to mix the barley meal and boiling water overnight so that it is ready for use the following morning.

Barley water-iron Experiment, 1935-36. The herd in September, 1935, consisted of nine foundation sows and their progeny. When saving gilts it had been the practice to select two, four or six gilts from a litter, and as a result batches of related sows farrowed down at intervals during the succeeding year. The litters for this experiment were selected in pairs, the two litters in each pair being as nearly similar as possible in regard to (1) Date of farrowing, (2) Breeding, (3) Number of pigs alive at three weeks old. Fourteen pairs were obtained during the year and in nine of these the dams were litter sisters. One litter from each pair was put into Group I and the other into Group II. The feeding and management of the two groups was similar in all respects except that the litters in Group I received barley water-iron and those in Group II received water in its place.

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TABLE I

RATIONS

	No. 1 <i>for In-pig Sows</i>	No. 2	No. 3 <i>for Nursing Sows</i>	No. 4 <i>for Sucking Pigs</i>
Barley Meal	25	45	37½	35
Maize	20	—	—	—
Flaked Maize	—	—	—	15
Weatings	45	40	40	50
Bran	5	5	5	—
Fish Meal	5	7½	5	—
Soya Bean Meal	—	2½	2½	—
Spray-dried Separated Milk ..	—	—	10	—

1½ lb. ground limestone and ½ lb. salt were added to each 100 lb.
of mixed meal in *all* rations.

The sows had free range on grass during the gestation period and received between 3 and 6 lb. per head per day of Ration No. 1. The quantity fed was determined by the amount of grass available. A record was kept of service dates, and a fortnight before sows were due to farrow they were brought up to the buildings. During the last fortnight of the gestation period they were kept in styes at night and allowed out to graze during the day, their ration being changed to No. 2. They farrowed indoors in pens that were divided into two compartments, a sleeping pen and a run. Both compartments had concrete floors. The piglings, which were weaned at 8 weeks old, were confined to these pens during the whole of the nursing period. The sows were allowed to go out for exercise on to grass land for about one hour a day after the piglings were a week old. The sows received Ration No. 1 during the nursing period. The quantity was restricted to 6 lb. per day for the first three days after farrowing, and subsequently increased gradually so that the maximum daily ration was reached by the time the pigs were between two and three weeks old. The maximum quantities fed were:

For sows nursing 9 or more pigs	..	12 lb. per day.
" " " 6-8 pigs	..	10 " "
" " " 5 or fewer pigs	..	8 " "

The sows had a supply of drinking water at their disposal during the day.

The Treatment of the Sucking Pigs in Group II. A creep for the piglings was constructed across one corner of the sleeping pen. After the piglings reached the age of two weeks a low trough containing a fresh supply of barley water-iron

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was placed behind the creep each morning, the allowance being 1 pint on each eight pigs. Any that had not been drunk when the sows were fed in the afternoon was removed and thrown away or given to older pigs. Some litters started to drink the mixture when they were two weeks old, others not until they were three or four weeks old, and two not until they were five weeks old, but up to the date of writing, out of 89 litters to which the mixture has been offered only six have failed to drink it. As soon as it was noticed that the piglings cleared up the barley water-iron, a little extra barley water was given, in order to ensure that they obtained their full allowance of iron; the quantity of barley water added was regulated carefully so that all the mixture was cleared up each day. It is difficult to give any guide regarding quantity because some litters drink more than others and also piglings drink more in hot weather than in cold. The quantities given in Table II are the maxima that were used:—

TABLE II
MAXIMUM AMOUNTS OF BARLEY WATER-IRON AND BARLEY
WATER USED

<i>Size of Litter</i>				<i>Allowance of Barley Water-iron</i>	<i>Maximum Amount of Additional Barley Water Used</i>
4 pigs	..	..	..	$\frac{1}{2}$ pint	$1\frac{1}{2}$ pints
6				$\frac{1}{2}$ "	$2\frac{1}{2}$ "
8				1 "	3 "
10				$1\frac{1}{2}$ pints	$3\frac{1}{2}$ "
12				$1\frac{1}{2}$ "	$4\frac{1}{2}$ "
Over 12				2 "	$5\frac{1}{2}$ "

The cost was about 1s. per litter.

The piglings were shut in the sleeping pens at feeding time from the age of three weeks in order to prevent them eating any of their dam's food. When they were three weeks old a trough containing dry meal was placed beside that containing the barley water-iron, Ration 4, Table I being used. This was removed each evening in order to avoid encouraging rats, a fresh supply being given each morning. The piglings were observed to nose about in the dry meal but did not, as a rule, eat a very large amount of it. Between the ages of 4 and 5 weeks the piglings were offered a little of the same ration, No. 4, which had been soaked. In the first instance this was done in the afternoon, as it has been found that pigs have a sharper appetite at that time than they have in the morning. When they would eat the soaked food it was given to them twice a

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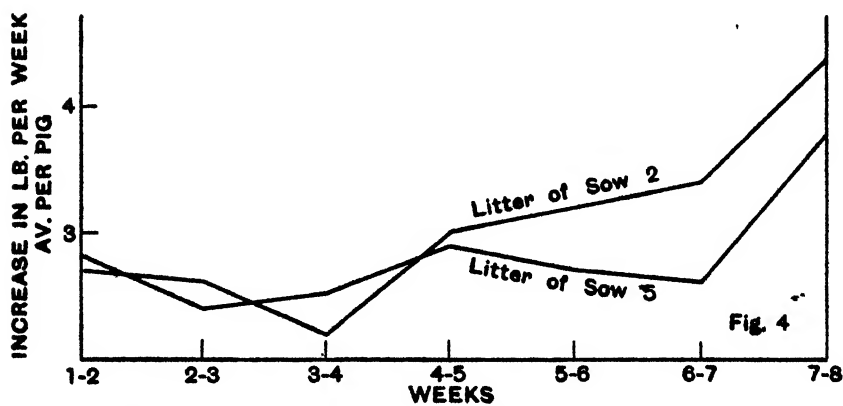
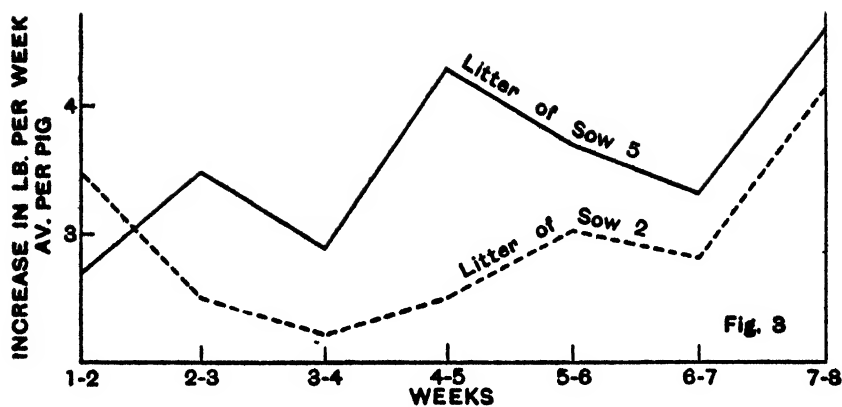


FIG. 3.—1st Litter of Sow 5 (Group I) receiving barley water-iron, and Litter of Sow 2 (Group II)—Control.

FIG. 4.—2nd Litters of same Sows, both of which received barley water-iron.

Barley water-iron Litters (Group I) —————
Control Litters (Group II)

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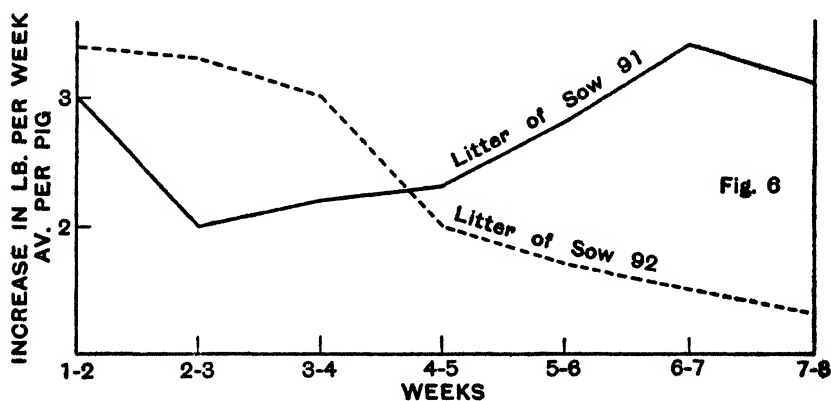
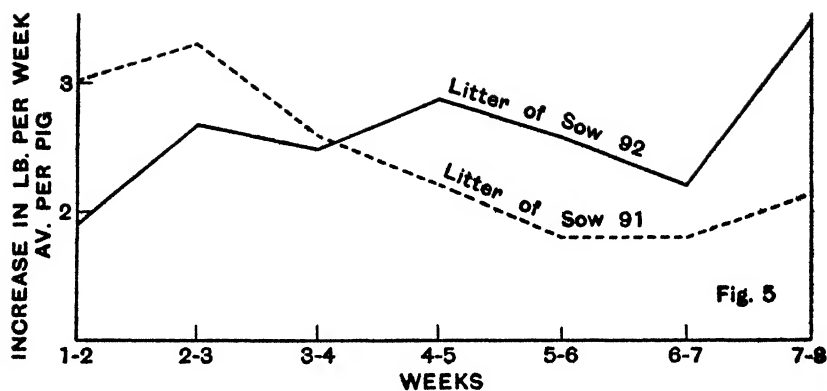


FIG. 5.—1st Litters of Sow 92 (Group I) receiving barley water-iron, and of Sow 91 (Group I)—Control.

FIG. 6.—2nd Litters of Sow 91 (Group I) receiving barley water-iron, and of Sow 92 (Group I)—Control.

Barley water-iron Litters (Group I) —————
Control Litters

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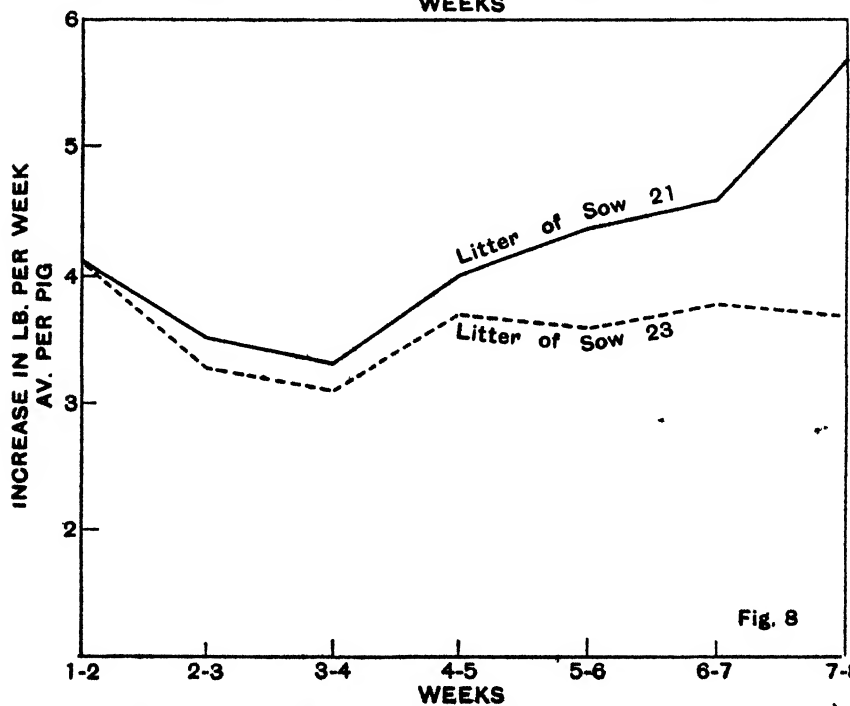
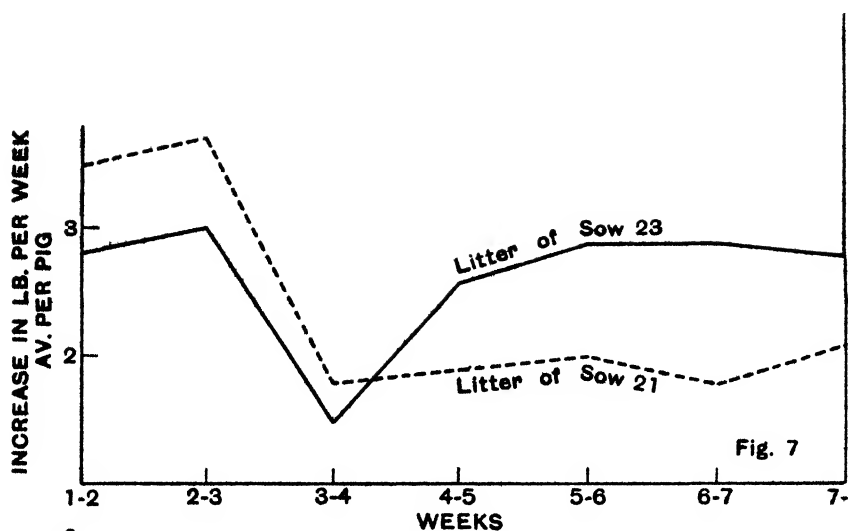


FIG. 7.—1st Litters of Sow 23 (Group I) receiving barley water-iron, and of Sow 21 (Group II)—Control.

FIG. 8.—2nd Litters of Sow 21 (Group I) receiving barley water-iron, and of Sow 23 (Group II)—Control.

Barley water-iron Litters —————
Control Litters

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day and as soon as they were eating an appreciable quantity of it the barley water-iron and the dry meal were discontinued. Twelve out of the fourteen litters in Group I were eating soaked meal within two days of the age of five weeks, but the other two did not start until they were six weeks old. The quantity of food was strictly rationed, the piglings only receiving the quantity they would clear up readily, because it has been observed that overfeeding is apt to cause digestive troubles.

The Treatment of the Sucking Pigs in Group II. This was identical with that of those in Group I except that they received plain water instead of barley water-iron.

Results. It was observed that during the autumn and winter there was a smaller proportion of unthrifty pigs at weaning in Group I than in Group II; Fig. 1 shows one of the autumn litters from Group I and Fig. 2 the comparable litter from Group II.

The piglings in Group I suffered less from scour than did those in the comparable litters of Group II.

In eleven out of the fourteen pairs the litter in Group I started to eat solid food at an earlier age and subsequently developed a normal appetite quicker than the comparable litter of Group II.

The litter averages of the fourteen pairs are summarized in Table III.

TABLE III
SUMMARY OF LITTER AVERAGES

	<i>Group I</i> (Receiving Barley Water-iron)	<i>Group II</i> (Control)
<i>Number of litters</i>	14	14
<i>Number of pigs at 3 weeks*</i> :		
Total	132	124
Average per litter	9.4	8.8
<i>Mortality :</i>		
Before weaning (3-8 weeks)	1	8
After " (8-12 " ")	10	15
Total (3-12 " ")	11	23
<i>Number of pigs weaned :</i>		
Total	131	116
Average per litter	9.3	8.3
<i>Average weight per pig at 8 weeks</i>		
old	28.2 lb.	26 lb.

* The barley water-iron was given from 2 weeks old, but could not be expected to have an appreciable effect before the pigs were 3 weeks. Losses before the latter age have therefore been omitted from the figures.

The most notable difference is to be found in the mortality between the ages of 3 and 12 weeks. During this period

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eleven pigs were lost from Group I as compared with twenty-three from Group II. The losses in both groups were confined to the autumn, winter and early spring litters, only one pig being lost from litters farrowed in March, April, May, June and July. All the piglings received a vermifuge when nine weeks old and some of the pigs lost suffered noticeably from the treatment. It is possible that these pigs might have survived had they not been treated for worms, but in any event they were weakly pigs that would have been costly to feed. The deaths, which occurred one at a time, were spread over 8 months and it is doubtful whether the magnitude of the death rate would have been realized if a record had not been kept. The pigs that died in Group II showed the pallid appearance of the skin and mucous membranes which is symptomatic of anaemia, and blood and post-mortem examinations, made by the Veterinary Department, revealed the fact that the internal organs also had the pallid colour characteristic of the acute form of that disorder.

Conclusive evidence of the value of the barley water-iron given to Group I was obtained from a study of the growth of the piglings. These were weighed each week, and it was found that after birth they grew rapidly for two, three or four weeks, but that at some period between the ages of 2 and 5 weeks a decrease occurred in the *growth rate* of most of the piglings. This decrease, which was very clearly marked in all except one of the litters in Group II, was comparatively small in twelve of the fourteen litters of Group I; in addition, whereas the growth rate of the former remained at a comparatively low level for *several weeks*, that of the latter recovered in *one week*. Typical growth-rate curves of pairs of the litters are given in Figs. 3 and 4, Figs. 5 and 6, Figs. 7 and 8. The effect of the barley water-iron is best seen by comparing Fig. 3 with Fig. 4, Fig. 5 with Fig. 6, and Fig. 7 with Fig. 8, as these give the curves of consecutive litters, from the same sows, for which the treatment was reversed.

The standard of growth of the five summer months was significantly higher than that obtained during the seven autumn and winter months, the figures being:—

<i>Groups I and II</i>	<i>Average No. of Pigs Weaned per Litter</i>		<i>Average Weight per Pig lb.</i>	
	
18 litters weaned, October—April	..	8.7	..	25.3
10 " " May—September	..	9.0	..	30.3

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There was a clearly marked difference between the growth of the nine autumn and winter litters in the two groups. In Group I, 9.2 pigs were reared per litter and the average weight per pig was 26.7 lb., the comparable figures for Group II being 8.2 pigs per litter and an average weight per pig of 23.8 lb. The difference between the growth of the summer litters of the two groups was smaller; in four out of the five pairs, however, the growth-rate curves showed that the growth of the litter in Group I was superior to that of the comparable litter in Group II during the critical period between the ages of 2 and 5 weeks.

Discussion of Results. There is ample evidence that in many instances sucking-pigs can receive a supplementary ration containing protein-rich foods, such as fish meal, meat meal, etc., without any ill effects accruing. The observations made in 1934, however, indicated that *under certain conditions* sucking-pigs that receive a supplementary ration containing foods rich in protein are more subject to scour than if a mixture that consists of cereal meals and minerals only is used as the supplementary ration. The results obtained with Ration 4, Table I, were sufficiently good to warrant a trial being made with a ration of this type whenever the incidence of scour is unduly high.

The only difference in the feeding and management of the two Groups in the 1935-36 experiment was that Group I received barley water-iron, which was not given to Group II. Thus the improved growth and lower mortality of the former group must be attributed to that mixture.

It is apparent from the growth-rate curves that between the ages of 2 and 5 weeks the piglings passed through a very critical period, during which those in Group I derived considerable benefit from the barley water-iron. The evidence obtained from post-mortem examinations indicates that anæmia was widely distributed amongst the piglings of Group II, and the inference is that the benefit that accrued from the use of the barley water-iron was primarily due to the action of iron as a preventive of that disorder. In this respect the results appear to be parallel with those obtained by Baskett and Lamont.²

The benefit derived from the use of barley water-iron was greatest during the autumn and winter months, but even

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during the summer the benefit was sufficient to warrant the use of the mixture at that period of the year.

The cost of the barley water-iron given to Group I was about 1s. per litter, an insignificant figure when compared with the benefits it provided. The mixture is simple to make, easy to use, and quite safe, points that render it very suitable for use on commercial farms.

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THE CONTROL OF POTATO BLIGHT BY SPRAYING AND DESTRUCTION OF HAULM

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The summer of 1936 was notable for the widespread incidence of Blight (*Phytophthora infestans*) on the potato crop. In the potato-growing districts of West Norfolk the heavy summer rainfall produced an excessive growth of haulm, early attacks of Blight were experienced, and the subsequent weather conditions favoured the spread of the disease. During June and early July most of the main crop varieties were sprayed, but towards the end of the latter month, growth of the haulm became so dense that growers could not decide whether to continue spraying. Many farmers held the view that the damage to the haulm caused by the passage of the spraying machine would offset any beneficial effect from the application of the fungicide. There was the possibility, too, that the weather might become dry and the Blight infection be checked naturally.

By August the foliage of many of the crops of the variety King Edward VII was beginning to die down as a result of Blight attack, and there was further doubt as to the advantage of destroying the haulm by spraying with a dilute solution of sulphuric acid. In previous years, when growth had held out late into the season, it had been shown by Bates and by the present authors (this *Journal*, Vol. 42, No. 3, June, 1935, p. 231, and Vol. 43, No. 5, August, 1936, p. 457) that sulphuric acid spraying would reduce the amount of "blights" in the clamp, but it was not certain that this would be so in a season when the haulm was, in any event, being rapidly killed by Blight.

Through the courtesy of Mr. C. W. Cave these problems were investigated in field experiments on his farm at Terrington St. Clement, King's Lynn. All the experiments were conducted with the variety King Edward VII, grown on a medium silt soil. The investigations may be divided into three parts:—

(a) The effect on yield of a late spraying with Bordeaux mixture.

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(b) The effect on yield of the damage to the haulm caused by the passage of the spraying machine.

(c) The effect on yield and proportion of " blights " of destruction of the haulm with sulphuric acid and with copper sulphate.

Late Application of Fungicide. The number of sprayings with fungicide given to the potato crops in the district varies according to the incidence of Blight. If the disease does not develop to any serious extent then the crop may be sprayed once or twice only. When Blight is prevalent, as in 1936, a third, followed sometimes by a fourth, application of fungicide may be undertaken after the crop has been moulded up and cultivation between the rows has ceased.

An estimate of the value of a third spraying with Bordeaux mixture was obtained by means of a strip trial. The treatments were (1) crop sprayed twice, and (2) crop sprayed three times, with four replications of each. The plots were four rows wide and approximately 200 yds. long, and sections of the two centre rows were lifted and weighed. The crop was first sprayed during the last week of June and this was followed by a second spraying in mid-July. The third spraying, carried out at the end of July, temporarily checked the spread of Blight and prolonged the growth of the crop for an additional 14 days. As the following table shows, the extension of the period of growth was reflected in an increased yield :—

	<i>Yield of Ware Potatoes (1½ in) per Acre</i>
Crop sprayed three times with Bordeaux mixture	6.70 tons
Crop sprayed twice with Bordeaux mixture ..	5.86 "
Significant difference	0.58 "

It will be seen that the yield of ware potatoes (the yield of seed potatoes was not affected) was increased by 0.84 tons per acre, an increase that was economic. This result is of value even if it serves only to emphasize that spraying against Blight is well worth while in a year when the disease is present on the foliage. The experiment also shows, however, that when Blight attacks are severe, a late spraying with Bordeaux mixture does, in fact, check the rapid spread of the disease and thus leads to a heavier crop.

Damage by Spraying Machine. In the experiment just described it was not planned to investigate the extent of the

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damage to the crop caused by the passage of the spraying machine. Indeed, care was taken to exclude the possible effect of this factor by lifting and weighing rows over which only the nozzles of the machine had passed.

The effect of the damage by the sprayer was measured in a field of potatoes that had been sprayed three times with Bordeaux mixture. Each time this field was sprayed the spraying machine travelled between the same rows of potatoes, and it was thus possible to estimate the yields from rows of potatoes (a) between which the wheels of the spraying machine had been driven three times, and (b) over which only the nozzles and not the wheels of the machine had passed.

Sections of five rows of (a) and of five rows of (b) were lifted separately and weighed in the field. The yields per acre were as follows :

		<i>Yield of Ware Potatoes (1½ in) per Acre</i>
Rows along which wheels of machine had passed		7.20 tons
Rows along which wheels of machine had not passed		8.60 „
Significant difference		0.86 „

It will be seen that there was a lower yield of ware potatoes from the rows along which the wheels of the sprayer had passed. This reduction in yield is probably due mainly to the crushing of the haulm at the third spraying, though disturbance of the soil at each spraying, by the wheels and by the horse may also have affected growth.

This physical damage to the crop by the spraying machine, reflected by a reduction in the yield of ware potatoes of 1.4 tons per acre, at first sight appears serious, but it must be remembered that the wheels of the machine, and the horse, pass along the equivalent of only three rows. Therefore the actual loss in yield *per acre sprayed* is in proportion to the number of rows sprayed at a time by the machine. If, for example, a seven-row sprayer was used then the decrease in yield would be three-sevenths of 1.4 tons or 0.6 tons per acre of ware potatoes. On the other hand, an eleven-row sprayer does proportionately less damage, and on the results obtained in this trial, the decrease in yield with a machine of this size would have been 0.4 tons of ware potatoes over each acre sprayed.

When, therefore, the growth of haulm is dense a sprayer covering a large number of rows is desirable. With a small

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machine the benefits arising from the late spraying are likely to be offset by the damage caused to the crop in the actual operation of spraying. It is possible that haulm-lifters, fitted in front of the wheels, would prevent the crushing of haulm, and so lessen the damage to the crop, but without trial it is difficult to say whether they would be a success. Even if haulm lifters were found to be of value, however, there remains the damage caused by the treading of the horse, and therefore a large spraying machine would still possess advantages over one covering a small number of rows.

Destruction of Haulm. It has already been mentioned that in 1936 the haulm of King Edward VII potatoes died down during August, six to eight weeks earlier than in the two previous years, when the incidence of "Blight" was less severe. When it became evident that the foliage was dying rapidly it was felt that information on the effect of haulm destruction could be obtained in conditions very different from those experienced in 1934 or 1935.

A trial was accordingly planned to repeat that carried out in 1935 (this *Journal*, Vol. 43, No. 5, August, 1936, p. 457), when a comparison was made between Brown Oil of Vitriol (commercial sulphuric acid) and copper sulphate as materials for the destruction of the haulm. The three treatments were as follows:—

1. Unsprayed.
2. Sprayed with 100 gallons per acre $12\frac{1}{2}$ per cent. solution (by volume) of Brown Oil of Vitriol.
3. Sprayed with 100 gallons per acre $7\frac{1}{2}$ per cent. solution (by weight) of copper sulphate.

The sprays were applied with a horse-drawn machine of standard type on August 13, 1936, four weeks before lifting. Each plot was six rows wide and 176 yards long, there being four replications of each treatment. The produce from one of the two centre rows of each plot was lifted and stored separated from its neighbours in the clamp by layers of straw.

When the crop was sprayed the foliage was being killed by Blight. Destruction of the haulm was less rapid with the copper sulphate solution than with the sulphuric acid, but when the crop was lifted the foliage was completely dead on all the plots, including those that had not been sprayed with acid or copper sulphate.

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The clamp was opened on January 14, 1937. "Blight" and "lumps" (misshapen and cracked tubers) were set aside and weighed separately, the remaining tubers being graded into ware (over 1½ in.), and seed and chats.

The results were as follows:

		Yields per Acre. Tons				Blight as per cent. of Total Yield
		Total Yield	Ware	Seed and Chats	Lumps	
Unsprayed	..	10.1	8.0	0.9	0.7	4.9
12% sulphuric acid (B.O.V.)		9.4	7.2	1.1	0.6	5.3
7½% copper sulphate	..	10.1	8.0	1.1	0.6	4.0
Significant difference	..	0.68	0.65	0.41	0.37	—

Spraying did not reduce the amount of "blights" in the clamp, but it will be noticed that the proportion of blighted tubers was small even from the unsprayed plots. This is presumably because the disease killed the foliage on these plots long before lifting began, and therefore there was little or no contamination of the tubers with living Blight spores during the operation of lifting.

It will also be noticed that the yield of ware potatoes was appreciably reduced where the crop was sprayed with sulphuric acid. This may be due to the rapid "kill" of the foliage secured with this material. In 1936 as in 1935, it was noted that both the unsprayed plots and the plots sprayed with copper sulphate remained green (especially the stems of the plants) for a period varying from one to two weeks longer than the plots sprayed with sulphuric acid. The foliage on the latter plots was killed in a few hours. In the trials of 1934 and 1935, the haulm was destroyed when the crop apparently had reached maturity, and the rapid "kill" by the sulphuric acid did not prove deleterious. In 1936, however, the crop was sprayed with acid or copper sulphate before it had reached full growth, and the curtailment of the growing period by sudden destruction of the foliage prevented any further increase in the size of the tubers.

The results of this trial suggest, therefore, that there is little to be gained by destruction of the haulm four weeks before lifting in seasons when the incidence of Blight is early and the foliage is rapidly being killed by the disease. The sudden stopping of growth may, in fact, result in a lighter crop. If in such seasons

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it is desired to destroy the haulm as a preventive measure against Blight infection of the tubers, it is recommended that a dilute solution of copper sulphate applied three or four weeks before lifting, should be used in preference to sulphuric acid. Copper sulphate does not kill weeds so effectively as sulphuric acid, however, and where weed growth is likely to interfere with lifting it is suggested that the potato haulm should be allowed to die down before destruction of the weeds with sulphuric acid is undertaken.

It must be emphasized that these conclusions do not apply in seasons when the haulm of King Edward potatoes remains green until lifting. It is in such seasons that the greatest degree of infection of the tubers with Blight is to be expected, and it is then that destruction of the haulm three weeks before lifting with copper sulphate or sulphuric acid has proved to be of value.

Summary. Attacks of Blight (*Phytophthora infestans*) were widespread and severe on potato crops grown in the Marshland district of West Norfolk in 1936.

Experiments on King Edward potatoes showed that a late application of Bordeaux mixture prevented the rapid spread of the disease and increased the yield of ware potatoes.

Some damage to the crop was caused by the passage of the spraying machine, and this was reflected in a reduced yield. On an acreage basis this reduction in yield becomes proportionately smaller the larger the machine used.

Spraying with sulphuric acid or copper sulphate four weeks before lifting did not reduce the proportion of "blights" in the clamp. Spraying with sulphuric acid reduced the yield of ware potatoes, probably owing to growth being suddenly stopped before the crop had reached maturity.

The authors wish to acknowledge their indebtedness to Mr. C. W. Cave, for allowing the experiments to be carried out on his farm and for the free use of his staff and equipment.

ELECTRICAL HEATING FOR HORTICULTURAL PURPOSES

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When it is realized that out of the coal burned at the power station less than one-third of its original energy appears as electricity, and that between the generating station and the consumer there are various sources of energy loss, it would seem that to contemplate using electricity for heating in competition with direct combustion of coal or oil is utterly hopeless. The position, however, is hardly so bad as it would seem at first sight, because while the small consumer has to reckon with coke costing from 30s. to 40s. per ton or coal from 40s. to 60s. per ton, the coal burnt at the generating station may cost as little as 10s. per ton. Nevertheless, while electricity can be produced at a modern generating station for a very small fraction of a penny per unit, the costs entailed in transmitting and distributing it to the consumer result in a gross cost at which, on a sheer cost basis, it cannot compete with the direct combustion of coal, coke or oil.

Electricity, however, does possess certain characteristics that enable it to be used in competition with direct combustion and under certain circumstances to have the advantage. It is clean, quiet, fumeless and easily controlled; it can be readily applied at specified and confined points; it is more easily installed in existing premises or structures, and this can often be done at a comparatively low cost; it need not be used except when required and then responds immediately and at full power to any sudden demand for heat. Again, its use entails the minimum of labour, though this may be a doubtful argument to a farmer, as much of the labour required for the heating plant can be worked in with other part-time jobs. To the properly planned nursery or market garden, with its staff employed up to the full and where heat is required, the

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electrical method can be applied without any increase in the staff. This is a point of particular appeal to the man running a small but high-class business either single-handed or as a family affair. Yet even to him—perhaps in a way more so to him—the cost of running is vital, and the main factor deciding whether electricity can be used for a particular horticultural heating purpose is the extent to which the heat produced can be conserved. This is, of course, apart from the cost of current itself, but there are few areas where it is not available at from $\frac{1}{2}$ d. to 1d. per unit, even if some restriction in the period of use is imposed.

Glasshouse Heating. The most important use of heat in horticulture is for the glasshouse, and the prospects of using electricity for this purpose will immediately come to mind. They are, however, very poor, for the conditions involved are about the very worst that could be conceived for heating by electricity. Not only is there a bulk of air to be warmed, but the huge expanse of glass causes rapid heat loss to the outside air; insulation against this is impracticable although double glazing has been tried on small greenhouses with satisfactory results. Again, the large commercial glasshouse lies generally in a group with others, using one common boiler-house, and the overhead and labour charges are spread out so that much of the advantage of electrical heating in saving installation cost, room and labour are not realized.

Electrical heating of the glasshouse would be done either by heating water in an electric boiler or by having electric heaters directly in the glasshouses. The former method has been tried abroad and is technically sound, but it is less efficient than the latter; on the other hand, it should enjoy much lower rates for electricity owing to the heat storage possible in the water, allowing "off-peak" and night heating to be done. The second method is more efficient as all the heat produced is passed straight into the air in the glasshouse and would be effected by installing tubular electric heaters. The second method has the further advantage that the heating tubes may be placed exactly where required for best heating, without having to consider water circulation and, of course, they take up considerably less space than water pipes. Particulars of the consumption of electricity for large-scale glasshouse heating do not seem to be available, although the author came across a medium-sized plant in France, running at the equiva-

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lent of $\frac{1}{4}d.$ per unit with apparent success; unfortunately satisfactory particulars of the cost of alternative heating were not available. There is little doubt, however, that large-scale glasshouse heating could hardly be contemplated unless electricity is as low as $\frac{1}{2}d.$ or more probably $\frac{1}{4}d.$ per unit, and even then some considerable importance would have to be laid on the operational advantages of electricity to justify its use.

While, then, it would appear to be unlikely that commercial glasshouse heating is an economic proposition, electrically, there is a stronger case for making a partial use of electricity as auxiliary to the main heating. As indicated above, the lay-out of the piping in a glasshouse may, from considerations of water circulation, be far from ideal in the matter of heat distribution, and there will be cool spots; in any event there will be cooler parts towards the outside of the house. By judicious placing of tubular electric heaters with thermostat control, these places may be maintained at the general temperature for a moderate consumption of electricity and as much as $\frac{1}{2}d.$ per unit may be justified for this purpose.

Again, the electric tubular heater is an ideal way of heating the amateur's greenhouse, where cost of running is not a primary consideration, provided it is reasonable, and time and labour saving are of great importance. This particularly applies when a cold house is converted for heating, which can be carried out with least disturbance by fitting tubular electric heaters. An average weekly consumption of about 1 unit per 10 cu. ft. of space might be expected to maintain a temperature of about 45° to 50° F. from October to March. Few towns cannot supply such a load at $\frac{1}{2}d.$ per unit, and most rural supplies have a special thermostat rate of $\frac{1}{4}d.$ Tubular heaters are available in lengths of about 2 feet and upwards and in a wide range of loadings from 100 watts; they cost from about 7s. 6d. per 100 watts in the smaller sizes to some 5s. per 100 watts in the larger sizes. In order to maintain a temperature of about 20° F. over outside temperature, the loading of the heating equipment should be of the following order:—

For a house of	250 cubic feet space	..	1 to $1\frac{1}{2}$ kW.
"	"	500	" " .. 2 kW.
"	"	1,000	" " .. 3 kW.
"	"	2,000	" " .. 4 kW.

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A thermostat is almost essential and costs from about 30s. upwards. Should frost protection only be required and not more than 250 watts be installed, a small vacuum type thermostat is available at about 8s.

Soil Heating. Electricity can also be used for supplying bottom heat for forcing or propagation under frames and lights. The simplest way of doing this is by passing a current directly through the soil which warms up as a result. This has grave technical objections, however, and it is more usual to pass the current through a wire buried in the ground, causing the wire to heat up and thus to warm the ground. Where the ordinary supply voltage of 230 volts or so is used the wire is enclosed in heat- and electrical-insulation and made up in the form of a flexible cable. By using a transformer and reducing the voltage to 15 volts or so comparatively heavy section bare iron wires can be laid direct in the ground and the installation is altogether stronger. On the other hand, the heating cable has turned out to be more robust than was expected and at the same time the low tension system has only been offered in this country in small sizes, in which it is much dearer than the cable. Certain foreign installations have been carried out on a fairly large scale using transformers and bare heating wire.

Whichever system is used its application depends essentially on laying the cable or heating wire in the ground with sufficient depth of soil above to grow the seeds, plants or cuttings inserted. In practice the method of installation has several modifications. In the first place, in order to improve heat distribution, the cable should be laid in sand consisting of a layer of 1 inch thick below and a similar layer above the cable. If the bed is required for market garden work and the direct growing to maturity of lettuces, etc., a 6 to 8-inch layer of soil should then be placed over the sand; if a layer of fairly small mesh wire netting is placed between the sand and the soil, the cable is protected from damage by spade at least and to a certain extent from damage by fork. If, on the other hand, the bed is required for nursery work—the raising of seedlings, propagation of cuttings, etc., in boxes and pans—the top layer of sand should be increased in depth to 3 inches or so; thus the hot cable will provide a warm bed on which the boxes and pans can be placed as required. For large scale propagation the

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depth of sand can be increased still further and cuttings inserted directly into it.

Another important modification is the provision of heat insulation to conserve the heat generated in the cable and thus save electricity. There are economic and practical difficulties in the way of effecting really comprehensive heat-insulation, but certain simple precautions enable an appreciable saving in current to be made. Heat loss from the bottom of the bed into the ground can be checked by starting with a preliminary bed of clinkers, broken tiles or bricks, etc., at least 6 inches deep and extending beyond the bed by a foot in each direction; this clinker bed can be let in so that it finishes flush with the ground and provides drainage if such be necessary, but in all but very well drained soil, the covering layers of sand and cable should be above ground level. The next source of heat loss is from the sides of the frame which ought to be substantially built and faced with a thickness of slab cork or one of the patent insulating boards and painted with bitumen to protect it from the weather; a simpler way, perhaps, is to add a second layer of boards to the sides with a layer of stout paper between.

The most serious source of heat loss is, however, through the lights themselves, and while some of this loss can be prevented by having well-fitting lights, much of it continues through the glass. This cannot be prevented during daylight, except perhaps by double-glazed lights, but it can be substantially reduced at night by covering the lights with hessian, straw matting, etc. This should be done systematically soon after sun-set and the covering should be in a businesslike arrangement for easy work; odd sacking held down by boxes and stones is simply an incentive to indifferent covering and is likely to be blown away in a high wind. These precautions are of no mere academic significance; tests have demonstrated that simple precautions such as are indicated above have resulted in substantial savings in electricity. Compared with uninsulated beds, bottom insulation has resulted in a saving of 6 per cent. over a period, side-insulation in a saving of 25 per cent. and top-covering at night in a saving of as much as 26 per cent. in the electricity required to maintain a given temperature.

It will be realized, therefore, that an installation that makes no provision against heat loss starts at an economic dis-

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advantage, and it is very doubtful whether one would care to suggest the possibility of economic success unless some such provision is made. This, therefore, is a difficulty in the way of using cables in beds that are moved frequently as is done in certain systems of intensive market-gardening.

The cost of the electrical installation will depend on the area of bed which is covered by a length of cable. Cables are made in different lengths, normally rated for use on the standard 230 volts, and giving a range of loadings in watts. As the heat generated is proportional to the wattage loading—1,000 watts will generate about 3,400 British Thermal Units per hour—this is a handy way of referring to the loading of cables in the beds. For market garden work—raising lettuces and catch crops—a low loading of 5 watts per sq. ft. bed area should be sufficient for normal conditions and, although entirely satisfactory results have been obtained with a loading as low as 3 watts per sq. ft., this is not generally to be advised. A maximum of 7 watts per sq. ft. should be observed as, even at this loading, there is a danger of high temperatures being reached, which are for this class of work almost more dangerous than low temperatures. This presupposes that hand control will be used, as is more likely for this class of work, but even if a thermostat is fitted, while the danger of overheating disappears, there is no point in increasing the loading much beyond 5 watts per sq. ft. as this simply puts up the cost of equipment. Nursery bed work is on a higher scale of requirement and returns, and should certainly be controlled by thermostat. The loading will be higher to meet the higher temperatures required and should not be less than 7 watts, but need not be more than 10 watts per sq. ft. These loadings are, of course, only approximate, and since there is only a limited selection of cables, the cable to give the nearest loading in a required bed should be chosen. Some of the popular sizes and prices are:—

125 watts	..	..	25 feet	..	..	10/6
200	..	..	30	..	..	11/6
490	..	..	100	..	..	24/6
700	..	..	150	..	..	32/-

Should a loading of 5 watts per sq. ft. be required in a bed measuring 4 ft. x 18 ft. or 72 sq. ft., the total loading required is 72 x 5 = 360 watts; the nearest single cable is 490

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watts and this will make the loading 6.8 watts per sq. ft. Alternatively two separate 200 watt cables could be used giving a closer loading to that desired. Again, the 490 watt cable might be used and a further light added to the bed.

To the cost of the cable must be added that of service wiring and switch, as well as the thermostat if fitted. It is impossible to give any really helpful indication of the cost of the service wiring, which will vary with distance and local conditions, but it may be remembered that the minimum necessary for one small cable will generally be sufficient to serve and control several. For the average nursery or market-garden hot-bed, an adjustable thermostat complete with either flexible or rigid extension should be used, and these are available at from 30s. to 70s. according to the total load to be controlled. For cables of 200 watts and under, however, there is available an evacuated glass thermostat which can be supplied ready built into the cable for about 15s. extra. Although this thermostat will control only to the temperature specified when ordering, in practice, by altering the position of the thermostat in the soil, a certain amount of temperature variation can be attained. This "self-regulated" cable is particularly valuable to the amateur gardener, but is useful in commercial work when small units are employed, and affords a very flexible system of operation.

The cost of running is widely variable according to the maintained temperature, the outside temperature and the efficacy of the heat insulation, and it may be said with some emphasis that unless some trouble is taken with the last, there is every chance of the running costs increasing beyond the limits of sound economics. In a reasonably well-protected bed lettuces should be raised to maturity at the earliest period of the year consistent with adequate light for 1 unit per head, any catch-crops being grown for no extra cost. This means that a maximum figure of $\frac{1}{2}d.$ per unit is necessary for growing lettuces by electrical heat, which figure, plus a fraction of a penny for overheads, should be earned by early and first-class lettuce. In running a nursery bed at from 60° to 70° F. during early spring, some 10 to 15 units per 6 ft. × 4 ft. light per week may be expected, the consumption falling off in late spring and summer. It must be realized that the full advantage of the electrical heating is only reaped if the maximum use of the bed is made throughout the year. This is

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possible with the nursery hot-bed which can be kept reasonably full of seed-pans, seedlings and cuttings for practically the whole year round. Even the man who hitherto grew only one crop of lettuce should amend his plans to make some further use of his beds.

The arrangement may follow that generally adopted for hot-beds, bearing in mind that cold winds are a potent source of heat loss and expense. Some sort of wind-break to north and east is strongly recommended. The nurseryman, with a somewhat more complicated programme than the market gardener, might well consider arranging his beds in three banks or groups. The first would be loaded up to, say, 7 watts per sq. ft. and would be the *hot-beds*; a second lot would be loaded more lightly at, say, 3 to 5 watts per sq. ft. as an intermediate cooler bed, and the third would be a cold bed entirely except, perhaps, for a cable carried round the inside of the frame to afford frost-protection.

A modified method of applying heat to tomato growing is being tested in the United States and this country, whereby the plants are grown on fibrous matting suspended over shallow tanks holding liquid solutions containing all the food constituents required for growth. The roots of the plants extend into the tank, which is kept at a determined temperature by thermostat control of electrical heating cables immersed in the solution.

The initial results show a substantial increase in crop more than sufficient to meet the cost of current used, and the results of further and larger scale tests are awaited with considerable interest. If the earlier results are confirmed the method should have considerable attraction, not so much for the large-scale commercial tomato grower, as for the small grower who would thereby be enabled to increase his output without increasing his glass area and without affecting general market values.

Another important application of heat in horticulture is for sterilizing the soil. This can be done electrically either by bringing wires into the soil and raising them to a sufficiently high temperature to raise the soil in its turn to a sterilizing temperature. A better way, however, is to pass the current through the soil itself, which will in this way be heated up. This is done by inserting copper plates the appropriate distance apart in the soil and passing current from one to another of these electrodes. Although this could be done direct in the

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ground as in a glasshouse, it is best, for reasons of economy and practice, to confine this method to sterilizing comparatively small quantities in special boxes containing up to 10 cwt. or so. These boxes take generally one of two forms. The electrodes may be at either end of the box and the soil packed firmly between them, or one electrode may be on the bottom of the box, the other being on the underside of the lid which, when closed on to a full box makes contact with the soil. The current, the time required and the cost of sterilizing all depend on the kind of soil, its moisture content and the efficacy of its packing, but with average potting soil, well packed, the consumption for sterilizing is of the order of 30 units per cubic yard. At anything below 1d. per unit this can hardly be called expensive but even although it be not a cheap way of sterilizing, it is a handy and clean method of sterilizing that should appeal to the small man and to the amateur.

In conclusion, it is fair to say that the use of electricity for horticultural heating is technically sound and that it may be adopted with considerable confidence in trouble-free running for a period of five years, and even at the end of that time only part of the installation is at all likely to be faulty. At the same time, it must be realized that electricity is a high-class medium of energy-transfer and is only economic where certain favourable conditions exist. Its use should never be embarked on lavishly without careful planning, for which plenty of competent advice is now available. It is primarily the medium for affording the man in a small way of business or working single-handed that freedom from much of the tedious and hard work that the man employing labour is able to avoid. Particularly, then, the nurseryman or market gardener so placed would do well to consider at least, but to consider in the light of informed and experienced opinion, the possibility of electricity being economically available to him.

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RECENT CHANGES IN SHEEP BREEDING IN THE ARABLE AREAS—II

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Change in the Number and Distribution of Down Flocks.

The fortunes of the Down breeds have varied, for while all have suffered from the decline in arable sheep farming, individual breeds have been subject to influences that have compensated, to some slight extent, for this fall. First, the Down breeds have competed among themselves for the position left by the decline in the Longwools. Secondly, all Down breeds have not reacted alike to changes in consumers' demands such as the increased preference for lamb instead of mutton. Thirdly, there has been a decline in the popularity of pure breeds for commercial production and a consequent increase in the practice of cross-breeding.

There is no information as to the numbers comprising the various breeds in this country, and the main evidence for the fall in the Down breeds is the decline of some 40 per cent. in sheep in the arable areas. There is, however, one source of information that does not appear to have been examined hitherto, and that is the flock books of the respective Down breed societies. The value of this material may be limited, but as between one Down breed and another, the changes in the distribution of the pedigree flocks provide a useful indication of the popularity of individual breeds.

Evidence from the flock books of the most important Down breeds is given in Table 3:—

TABLE III.—NUMBERS OF REGISTERED FLOCKS OF FOUR DOWN BREEDS
IN 1910 AND 1935

Breed	1910	1935	Per cent. Change	
			British Isles	England and Wales only
Hampshire ..	490	169	— 65·5	— 65·5
Southdown ..	359	192	— 46·5	— 46·5
Oxford ..	175	97	— 44·6	— 65·3
Suffolk ..	246	340	+ 38·2	— 13·5

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There has been a decline in the number of registered flocks of all four of these Down breeds in England and Wales, the Hampshire and Oxford each showing a fall of no less than 65 per cent. Although showing a fall in England and Wales, however, the total number of registered flocks of Suffolks in the British Isles has actually increased by no less than 38 per cent.

It is probable that the fall in the numbers of sheep registered has been much greater than the fall in the number of flocks suggests, for the average size of the ewe flocks registered has also decreased, the Hampshire and Southdown showing falls of 43 per cent. and 39 per cent. respectively.

More striking however, than the fall in the total number of flocks is the change in the distribution of the breeds, and on this point the evidence of the flock books is particularly illuminating.

TABLE IV.—DISTRIBUTION OF REGISTERED FLOCKS
OF SUFFOLK SHEEP IN 1910 AND 1935

County				1910	1935
Suffolk .. .. .	..	..	..	154	63
Essex .. .. .	..	..	..	53	31
Norfolk .. .. .	..	..	..	17	10
Cambridge .. ..	..	..	..	8	8
Yorkshire .. ..	..	..	..	—	22
Northumberland	..	..	..	1	11
Shropshire .. ..	..	..	..	—	10
Warwickshire ..	..	..	..	1	7
Other Counties	..	..	..	11	50
				245	212
Scotland .. .. .	..	..	..	—	57
Ireland .. .. .	..	..	..	1	44
TOTAL .. .. .	..	..	..	246	340

In 1910, the Suffolk flocks were almost entirely in the arable areas, but twenty-five years later they were kept throughout the British Isles. In Suffolk itself, the number has fallen from 154 to 63, and this illustrates the extent of the decline in a typical arable county. The fall in the arable counties has been offset by an increase in registered flocks in the grassland areas, such as Northumberland, Yorkshire, Warwickshire and Shropshire, but there has been no change to arable sheep farming in these counties, and the increase in the Suffolk flocks is

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due to the popularity of the rams for crossing with the grass-land breeds.

The change in the distribution of registered Oxford flocks is also of interest. Before the War, Oxford rams were popular in the North of England and in Scotland for crossing with the Half-bred ewe, but their chief centre was in Gloucestershire and Oxfordshire. Like the Suffolk, the breed has declined heavily in the arable areas as Table 5 shows:—

TABLE V.—DISTRIBUTION OF REGISTERED OXFORD
FLOCKS IN 1910 AND 1935

County or Area	1910	1935
Gloucestershire	32	9
Oxfordshire	31	8
Northamptonshire	10	3
Shropshire	9	1
Yorkshire	9	11
Cumberland	7	2
Buckinghamshire	7	0
Other Counties	39	17
Ireland	16	14
Scotland	15	32
TOTAL	175	97

The future of the Oxford as a commercial breed is perhaps the most doubtful of all the Downs. It is the heaviest of the group, and like the Longwools, it has suffered both from the demand for small joints and from low wool prices. It is late maturing and for that reason the decline in winter fattening has particularly affected it. Moreover, for rams for crossing with the Scotch Half-bred, it has felt the competition of the Suffolk, as the fall in the number of registered flocks in Cumberland suggests. Only in Scotland has there been any appreciable increase in registered flocks.

Judging by the evidence of the flock books, the Hampshire has suffered more than any of the other Down breeds. At first sight, this is perhaps surprising, because its early maturing and excellent carcass qualities make it unrivalled for early lamb. The low fertility of the ewe, of course, makes it unpopular with some farmers, but perhaps the extent of the decline was largely due to its pre-war distribution rather than to the defects of the breed itself. It was the hurdled sheep *par excellence* of the chalk lands of the south, and these have had

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to meet the full effects of low corn prices without the compensations that sugar beet growing afforded elsewhere.

The five arable counties that showed the greatest decline in ewe population between 1910-12 and 1928-30 were Wiltshire, Berkshire, Hampshire, Dorset and Suffolk, and it is precisely these counties, which have experienced the largest fall in arable acreage, except that Sussex takes the place of Suffolk. The distribution of registered flocks, except as to numbers, is very much the same as it was twenty-five years ago :

TABLE VI.—DISTRIBUTION OF REGISTERED FLOCKS
OF HAMPSHIRE DOWNS IN 1910 AND 1935

County	1910	1935
Wiltshire	255	77
Hampshire	113	38
Dorset	41	13
Berkshire	19	12
Somerset	14	3
Others (under 10 flocks each)	48	26
TOTAL	490	169

The Southdown as a pedigree breed has spread in a few counties, notably Gloucestershire, but it is doubtful whether its commercial importance has been maintained. The number of registered flocks has fallen from 359 in 1910 to 192 in 1935, and there was also a heavy fall in the average size of flocks. The decline is all the more remarkable in view of the additional importance now attached to small joints and carcass quality. The decline of arable acreage, however, has been particularly heavy in Sussex, and it was inevitable that the Southdown should share the common experience, when arable sheep farming was in difficulties. Moreover, the Southdown is not so popular with farmers as might perhaps have been expected, for there was a widespread feeling that the quality premium obtainable for Southdown lamb was insufficient to compensate for the loss in weight.

Increase in Cross-breeding and Experiments. In discussing questions of breeding policy, it is important to emphasize the distinction between breeding to sell rams and ewes for stock, and breeding for the commercial production of mutton and lamb. Twenty-five years ago a few breeds,

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particularly the Southdown and the Hampshire, were normally kept "pure" for commercial production. It has long been recognized, however, that the cross-bred lamb has also qualities to recommend it. It is held that it thrives better and possesses more stamina. Before the War there were popular crosses, such as the Cotswold-Suffolk, the Oxford-Leicester, and the Southdown-Kent. In recent years there appears to have been a further decline in the commercial use of pure breeds, and to-day the practice of cross-breeding is more widespread, more complex and less systematic than it was twenty-five years ago.

The high proportion of cross-bred ewes offered at Marlborough August sheep fair has already been noticed, but the proportion of lambs of this type was even higher, no less than four out of every five being cross-bred.

TABLE VII.—BREEDS OF LAMBS OFFERED AT MARLBOROUGH FAIR
(AUGUST), 1933-35

	Crossbred	Un- classified	Hampshire Down	Other Pure Breeds	Total
Number ..	15,854	1,720	1,463	389	19,426
Percentage ..	81.6	8.8	7.5	2.1	100.0

If this were the position in a county in which Hampshire Downs had been the basis of commercial production, the prevalence of cross-breeding in areas less wedded to pure breeds can be imagined. Indeed, except for high-quality production with the Southdown, and early fat lamb with the Hampshire and Dorset Horn, pure breeding for commercial purposes was fast disappearing. Out of a sample of 41 farms, where cross-breeding was the accepted practice, no fewer than 26 had maintained pure-bred flocks before the War, and 14 of these were breeding from cross-bred ewes.

Usually the change has been gradual. The draft or older ewes have been selected for experiments, and when successful, the pure-bred flock has slowly been abandoned. The foundation of the cross has normally been the Down ram with its excellent carcass qualities. Where breeds of sheep unsuitable for modern requirements had been kept, the introduction of a different ram was the first step towards improvement and often gave an indifferent ewe a fresh lease of life. On a few farms a complete change in production was made possible, without

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the necessity of a drastic and expensive change of foundation stock.

Among ewes, the Longwool has been the most common object of experiment, the main efforts being devoted to a reduction in size and improvement in quality. Twenty-five years ago, the Oxford was the popular ram for the Longwool ewe, because the cross was as heavy, and yielded almost as much wool as the Longwool itself. Now, however, the Suffolk, and to a less extent, the Hampshire, are becoming popular, the former largely, for the high proportion of lean meat in its carcass, and the latter for its earlier maturing qualities. Again, the excessive size of the Lincoln can be reduced by crossing the ewe with the smaller Down rams. This method, however, is likely to be less economic than the use of small ewes and large rams, and a mere change of ram has not been sufficient to maintain the importance of the Longwool.

The spread of the grass ewe in arable districts, however, has been responsible for a greater increase in cross-breeding than has the decline in the commercial importance of the pure-bred Longwool. In the north, the Oxford was the accepted ram for the Scottish half-bred ewe, but in the south it has not been so popular. Here the primary object has been to secure a suitable cross for the fat lamb trade, and the Suffolk and the Hampshire rams have found most favour. A sample of the various types of crosses that were met with in the course of the survey is given in Table 8:—

TABLE VIII.—BREEDS OF RAMS AND EWES EMPLOYED FOR CROSSING
IN ARABLE COUNTIES

Rams	Grass Ewes or Crosses	Down Ewes or Crosses	Longw Ewes or Crosses	Total	Type of Production	
	No. of Farms where used	No. of Farms where used	No. of Farms where used		Fat Lamb	Winter fatten- ing
Hampshire ..	14	3	3	20	13	7
Suffolk ..	11	3	4	18	13	5
Oxford ..	1	1	5	7	—	7
Southdown ..	—	2	—	2	2	—
Other Rams	4	5	—	9	5	4

The predominance of Suffolk and Hampshire rams for crossing with the grass ewes in arable districts is clearly indicated, but in this sample the Oxford is still the most common

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cross with the Longwool. It is more interesting to note, however, that both the Hampshire and Suffolk are firmly established favourites for the fat lamb trade, while the Oxford is used only on farms where winter fattening is followed.

The Southdown does not appear to be widely used, and this is, perhaps, surprising. From an economic point of view, however, the use of a small ram on large ewes has little to recommend it and farmers appear to have realized this. It must also be remembered that for best quality mutton and lamb production, the Southdown, unlike other Down breeds, is normally kept pure.

In East Anglia, the Lincoln and Cotswold rams were commonly used on the Suffolk ewe, but in recent years the Lincoln has fallen completely out of favour, while the Cotswold appears to be fighting a losing battle to maintain its position. No single breed of ram, however, has yet established itself as the successor of the Longwool in this area, and various Down breeds are being tried.

Standardization. The complaint has been made that while the Scottish farmer of the lowlands decided 50 years ago what was the most suitable sheep for his farming, the English farmer is still struggling in a confusion of breeds. If the increase in cross-breeding be the result of deliberate and planned policy, it can only be regarded as a sign of a healthy interest in the problems of the industry, but if it be the result of indiscriminate and haphazard experiment, then the development is dangerous. It is necessary to consider, therefore, whether the breeds of sheep kept in the arable districts are too numerous, and if so, how far standardization of breeding is possible. The Pig Reorganization Commission passed severe strictures on the multiplicity of pig breeds and urged the need of a reduction. Does a similar situation exist in the sheep industry and if so, what are the obstacles to be overcome?

If a farmer has no desire to rear his own ewe lambs, he can buy ewes of the breed most suitable for commercial mutton and lamb production; but if the cost of replacing the ewes is very heavy, he may find it cheaper to breed from the best of his own lambs. Here, the producer of early lambs may find himself again in a difficulty, because he is always torn between the desire to sell as many as possible of his lambs fat and to retain the best for breeding. On some farms, this has led to the deterioration of the ewe stock because it was cheaper,

CHANGES IN SHEEP BREEDING

in the short run, to breed from inferior stock and sell all the best lambs to the butcher. If cross-bred ewes are to be kept, the fertility both of the ram and of the ewe must be taken into account, together with the milking capacity of their respective breeds. The success of the half-bred ewe suggests that ewes need not necessarily be pure-bred, but there is grave danger that in continuous crossing the importance of good foundation stock may be neglected and that breeding qualities may be lost in concentration on mutton and lamb production.

The qualities in the make-up of a good ewe are not necessarily incompatible with the production of the best mutton and lamb, while improvement is possible by crossing with a suitable ram. There are, however, limits to such improvement, and as the sheep industry is not homogeneous, the various sections of it are not always working to the same end. Broadly speaking, there are three main objects, (1) lambs for the early lamb trade, (2) lambs for the summer fat lamb trade, and (3) lambs for winter fattening.

For the early lamb trade the capacity to breed very early, such as the Dorset Horn and Dorset Down possess, is essential in the ewe. Fertility may be of secondary importance, because single lambs can meet the Easter market when twins would miss it. The lamb must be early maturing, a voracious feeder and capable of being forced on arable crops. These are qualities which the Hampshire possesses to a high degree, and both for rams for crossing and as a pure breed, it is widely used.

In the summer fat lamb trade, as distinct from the early trade, the fertility and milking capacity of the ewe are of prime importance. If, as seems probable, these fat lambs are to be produced more and more from grass, the advantage of choosing a grass ewe is obvious, and both the Scotch Half-bred and the Kerry Hill are being widely used. Few farmers have looked beyond the Down breeds in seeking a ram, for they give a native adaptability to the cross, which permits it to be finished on arable crops if necessary.

For stores for winter fattening, early maturity is not so essential, but the capacity to consume bulky fodder, and hardiness to withstand climatic conditions, are all-important. These were the qualities that established the reputation of the Long-wool breeds. The weight of wool is no longer of prime importance, however, and a wide choice of ewes and rams is available. If a grass ewe should be used, the presumption is that folding

CHANGES IN SHEEP BREEDING

blood needs to be introduced, and this again invites the use of Down rams.

With these divergent aims and methods of production, any rigid standardization is not to be expected. Specialization in production follows a well-defined demand, and for the early lamb trade pure bred flocks of the Dorset Horn, Hampshire and Dorset Down breeds will continue to have their place. Again, for the highest quality mutton and lamb production the Southdown is likely to maintain a position of its own in a limited area

Reasons have been advanced already for suggesting that the prospects of the recovery of the Longwool breeds are remote. The decline in winter fattening and in breeding on arable land, however, has equally affected the Down breeds, because it was inevitable that farmers should seek ewes better suited to the new conditions and try to breed lambs capable of meeting the changes in demand.

The confusion in breeding is largely the result of this transition. Many farmers were reluctant to change their tried favourites, but others have been quick to see the advantages of the grass ewe. The grass ewe, however, is not a complete solution of the problems of sheep farming in arable districts. It is not possible, even if it were desirable, for all farmers to produce nothing but fat lambs; only the best can be sold off their mothers to the butchers, and when attempts are made to intensify production this proportion often declines, owing to disease.

There is apparently room for the development of a compromise system. The grass and arable systems should be regarded as complementary, particularly in areas of arable farming, and if a new system is to develop, it would be based upon an extended use of temporary pastures, which would give some of the advantages of both.

Such a system would be founded on the grass ewe as the cheapest method of breeding, but probably a Down ram would be used. Many of the experiments in crossing have been directed towards the production of a dual-purpose lamb that could either be sold fat off the grass or finished on arable crops if necessary. The Down flocks are tending more and more to concentrate upon the supply of rams for crossing rather than upon commercial pure-bred production. The part played by the Down ram in the improvement of the crosses from Longwool ewes has been mentioned, but its future is likely to be

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rather for rams for crossing with grass ewes. The change in the distribution of the registered Down flocks lends support to this view. It is certain that the increase in the number of Suffolk flocks in Yorkshire, Northumberland, Warwickshire and Shropshire does not indicate a revival of arable sheep farming in these areas. The change in distribution is due to the popularity of the ram rather than of the ewe, the ram being principally used for crossing with the grass ewe. On the other hand, the Hampshire, although widely used, does not show any appreciable change in the distribution of its registered flocks, because its popularity for crossing with grass ewes is largely confined to the chalk areas of the southern counties, which have always been the stronghold of this breed.

The choice between breeds must be made on a balance of advantages, and what these are has been a matter for experiment. If the problems of the industry are clearly envisaged, however, there is little need for the present confusion. Certain breeds have little future in commercial production, and the arguments for a measure of standardization in breeding must eventually carry some weight.

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Milk Marketing Scheme. Pool prices and rates of producer-retailers' contributions for July, 1937, are given below, with comparative figures for June, 1937, and July, 1936. The wholesale liquid milk price in July of this year was 1s. 1d., in June 1s. and in July, 1936, 1s. 1d. per gallon.

	<i>Pool Prices</i>			<i>Producer-Retailers' Contributions</i>		
	<i>July, 1937</i>	<i>June, 1937</i>	<i>July, 1936</i>	<i>July, 1937</i>	<i>June, 1937</i>	<i>July, 1936</i>
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Northern	10	9½	9½	2½	2½	3
North-Western ..	10	9½	9½	2½	2½	3
Eastern	10½	9½	10	2½	1½	2½
East Midland ..	10½	9½	9½	2½	2½	2½
West Midland ..	9½	9	9½	2½	2½	3
North Wales ..	9½	9	9½	2½	2½	3
South Wales ..	10	9½	9½	2½	2½	3
Southern	10½	9½	10	2½	1½	2½
Mid-Western ..	9½	9	9½	2½	2½	3
Far-Western ..	9½	9	9½	2½	2½	3
South-Eastern ..	10½	10	10½	2	1½	2½
Unweighted Average	10·09	9·32	9·68	2·49	2·26	2·86

These prices are exclusive of any premiums for special services and level deliveries, and also of the Accredited producers' premium of 1d. per gallon.

The accredited premium was paid on 31,961,119 gal., and the sum required for the payment of the premium was equivalent to a levy of .341d. per gallon on pool sales.

The inter-regional compensation levy was fixed at 1½d. per gallon, compared with 1½d. per gallon in July, 1936. A levy of ¼d. per gallon was made for general expenses.

Sales on wholesale contracts were as follows:—

	<i>July, 1937 (estimated)</i>	<i>July, 1936</i>
	<i>Gallons</i>	<i>Gallons</i>
Liquid	50,499,151	47,439,779
Manufacturing	31,026,412	37,152,699
	81,525,563	84,592,478
Percentage liquid sales:	61·94	56·08
Percentage manufacturing sales: ..	38·06	43·92

The average realization price of manufacturing milk during July was 5.55d. per gallon, compared with 5.10d. per gallon

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for July, 1936. The quantity of milk manufactured into cheese on farms was 2,995,614 gallons, compared with 3,107,391 gallons in the previous month and 2,712,414 gallons in July, 1936.

Amendment of the Milk Marketing Scheme. On August 3, 1937, the Minister made an Order, under Section 1 of the Agricultural Marketing Act, 1931, amending the Milk Marketing Scheme. Copies of the Order, which is entitled "The Milk Marketing Scheme (Amendment) (No. 2) Order, 1937," (S.R. & O. 1937, No. 744), may be obtained from H.M. Stationery Office, price 5d. net.

The amendments, which, except where stated below, take effect as from August 4, 1937, deal *inter alia* with the following matters:—

Wholesale Producers owning not more than Four Cows. Such producers, who were exempted from registration under the original Scheme, must now be registered. The Board, by resolution, however, have exempted from the operation of the Scheme sales of milk by these registered producers until September 30, 1937, provided that the milk is delivered to the purchaser not later than that date. As from October 1, 1937, all sales of milk by such producers will be subject to the provisions of the Scheme.

Producer-retailers' Contributions and Condition of Producer-retailers' Licences. New rates of contributions for producers who sell by retail or semi-retail which take effect from October 1, 1937, and which vary according to the quality-category of the milk sold, are provided for as follows:—

Milk in category I (Tuberculin-Tested milk) ..	½d. per gal.
" " " II (Accredited milk)	1d. "
" " " III (other milk)	1½d. "

These rates are subject to a reduction of ¼d. per gallon if the contributions are paid within 14 days after they become due, but if a producer-retailer sells any milk by wholesale (except on contracts carrying level delivery premiums) his contribution will be increased by ½d. per gallon on all his retail or semi-retail sales. The Board are empowered to vary the above rates after July 31, 1938, except as regards Tuberculin-Tested milk.

An amendment also adds to the conditions that may be imposed by the Board in granting producer-retailers' licences, and the grounds on which the Board may refuse to issue such

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licences. The new conditions relate *inter alia* to the manner in which milk sold is to be graded, the persons to whom milk may be sold by semi-retail, and the nature of the books and records to be kept by producer-retailers. The Board will be entitled to refuse to issue a licence to a producer who owes a debt to the Board exceeding a specified amount.

Position of Producers of Tuberculin-Tested Milk. The Board, with the consent of the Minister of Agriculture and Fisheries, have withdrawn the exemption of sales of Tuberculin-Tested milk from the operation of Part VI of the Scheme, but sales of Tuberculin-Tested milk, sold as such, will continue to be exempt up to September 30, 1937, provided that the milk is delivered to the purchasers not later than that date. As from October 1 next, however, all sales of Tuberculin-Tested milk will come within the scope of the Scheme. Certain of the amendments of the Scheme approved by the Minister relate particularly to sales of Tuberculin-Tested milk and the position of producers of such milk under the Scheme is set out below.

Sales by Retail or Semi-retail. A producer of Tuberculin-Tested milk who desires to sell by retail or semi-retail must obtain a licence from the Board. No charge is made for this licence. Contributions payable to the funds of the Board in respect of Tuberculin-Tested milk sold by retail or semi-retail are fixed until October 1, 1939, at $\frac{1}{4}$ d. per gallon, subject to a reduction of $\frac{1}{4}$ d. per gallon if the contributions are paid within 14 days after they become due. If a producer-retailer sells any milk by wholesale (except on contracts carrying level delivery premiums) his contribution will be increased by $\frac{1}{4}$ d. per gallon on his retail or semi-retail sales. After October 1, 1939, the contributions may be varied to such extent only as a "consulted person," appointed by the Minister, may approve. The contribution payable in respect of Tuberculin-Tested milk on sales by retail or semi-retail is 1d. per gallon less than the contribution payable by registered producers on similar sales of ordinary milk.

The amendments of the Milk Marketing Scheme provide that sales of Tuberculin-Tested milk produced and bottled by a registered producer on his farm are to be regarded as sales by retail and that Tuberculin-Tested milk sold by a registered producer and delivered by him in quantities not exceeding in the whole 10 gallons in a day to any one purchaser shall be deemed to be sold by semi-retail.

Sales by Wholesale. Registered producers who sell Tuberculin-Tested milk by wholesale will be liable for the payment of the same levies and other charges of the Milk Marketing Board, and will be subject to the same liabilities and benefits under the Scheme, as wholesale producers who sell ordinary milk. They will, however, be eligible to receive the following premiums.

(i) Under the Milk Marketing Board's regulations relating to the Accredited Scheme, Tuberculin-Tested milk sold otherwise than by retail or semi-retail will be eligible for the premium of 1d. per gallon payable to producers of Accredited milk.

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(ii) Under the amendments of the Milk Marketing Scheme a special quality premium will be payable on all Tuberculin-Tested milk sold by wholesale. The amount of this premium is fixed by the Scheme at not less than 1d. per gallon until October 1, 1939, and thereafter may only be varied with the approval of a "consulted person" appointed by the Minister.

(iii) The amendments also provide that, where Tuberculin-Tested milk is sold, otherwise than by retail or semi-retail, at a prescribed price which is in excess of the prescribed regional price for ordinary milk, any such excess received by the Board shall be paid to the registered producer as if it were a special service premium.

Minimum Selling Prices. The Minister has requested the Milk Marketing Board to appoint an Advisory Committee, consisting of two representatives nominated by the Board, two representatives by the Tuberculin-Tested Milk Producers' Association, and an independent Chairman, to advise the Board as to the minimum prices that should be fixed for Tuberculin-Tested milk sold by wholesale and by retail.

The Attested Herds Scheme. Producers of Tuberculin-Tested milk who hold a Certificate of Attestation under the Attested Herds Scheme will receive the additional bonus of 1d. per gallon payable under that Scheme on all milk from the Attested Herd sold by wholesale, semi-retail or retail under the provisions of the Milk Marketing Scheme.

Miscellaneous. The amendments also provide for a minor alteration in the system of registering contracts; a revision, to take effect from October 1 next, of the system of assessing freight charges, in order to remove anomalies arising from the variation in such charges borne by individual producers sending to different approved depots in the same region; an improvement in the procedure for nominating and electing members of the Board, and an increase in the "requisite number" of producers who may demand a poll on the question of revoking the Scheme.

Potato Marketing Scheme. RIDDLE REGULATIONS. On August 5, 1937, the Potato Marketing Board passed a resolution prohibiting as from that date the sale by registered producers of any potatoes for human consumption, produced in Scotland, of the varieties Kerr's Pink and Red Skin that are capable of passing through a 2-in. riddle.

Hops Marketing Scheme. The Hops Marketing Board have agreed that the rate of levy contributions to be paid by brewers in respect of 1937 hops shall be 3s. per cwt. instead of 10s. per cwt. hitherto payable under the Agreement made between the Board and the Brewers' Society.

Draft Sugar Beet Marketing Scheme. The modifications proposed to be made by the Minister of Agriculture and

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Fisheries and the Secretary of State for Scotland to the Sugar Beet Marketing Scheme, as re-submitted by the promoters, were notified on July 14 to the persons nominated for the purpose in accordance with the requirements of Section 1 (5) (c) of the Agricultural Marketing Act, 1931. The nominated persons have applied for an extension of time to consider the modifications and the Minister and the Secretary of State for Scotland have accordingly extended the period to October 31, 1937.

Milk (Amendment) Act, 1937. This Act, which received the Royal Assent on July 30, 1937, continues for a further year, with some amendment, various provisions of the Milk Acts, 1934 and 1936, that would otherwise expire on September 30, 1937.

Section 1 extends for a further twelve months to September 30, 1938, the period in respect of which Exchequer advances may, subject to certain conditions, be made to Milk Marketing Boards in Great Britain in respect of milk manufactured at factories (whether owned by the Milk Boards or not) into butter, cheese, condensed milk, cream or milk powder, or manufactured into cheese on farms.

Section 2 extends for a further year until September 30, 1940, the period during which Milk Boards are under a contingent liability to repay these Exchequer advances. (As announced in paragraph 8 of the recent White Paper on Milk Policy, Cmd. 5533—see page 525 of this issue of the JOURNAL—it is proposed in legislation to be introduced next session to relieve the Milk Boards of any balance of this liability accruing after September 30, 1937.)

Section 3 extends for a further year, until September 30, 1938, the period in respect of which Exchequer advances may be made to Milk Marketing Boards in respect of schemes for increasing the demand for milk (including the Milk-in-Schools Scheme).

Under *Section 4*, the period in respect of which advances may be made to the Government of Northern Ireland in respect of milk manufactured into butter or cream at registered creameries is extended for a further year until September 30, 1938, and the period during which the Government of Northern Ireland are under a contingent liability to repay these advances is similarly extended for a year, until September 30, 1940.

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Under Section 4 of the Milk Act, 1934, the cheese-milk price for any month, which governs the rate of payments both to the Milk Boards and by the Milk Boards in respect of milk used for manufacture, was defined as the excess over 1½d. of the average of the prices per lb. at which New Zealand finest white cheese and Canadian finest white cheese was sold wholesale in Great Britain during the immediately preceding month. Section 5 of the present Act provides that as from August 1, 1937, the cheese-milk price is to be such sum as the Minister of Agriculture and Fisheries and the Secretary of State for Scotland, acting in conjunction, may, with the approval of the Treasury, certify to represent the value per gallon of the greater part of the milk, which, during that month, was sold wholesale in Great Britain for manufacture into cheese. The Section further provides that as from August 1, 1937, the payments to the Board or by the Board in respect of milk used for manufacture into butter, shall be governed, not by the cheese-milk price but by the monthly butter-milk price which is defined as such sum as the Minister of Agriculture and Fisheries and the Secretary of State for Scotland, acting in conjunction, may, with the approval of the Treasury, certify to represent the value per gallon of the greater part of the milk which, during that month, was sold wholesale in Great Britain for manufacture into butter.

Section 6 of the Act provides that the expression " net cost per gallon of the milk to the purchaser " in Section 1 of the Milk Act, 1934, shall be construed in effect as meaning the manufacturing price for the milk with such additions, if any, thereto as the Minister may determine as representing other sums payable in respect of the milk in question.

Section 7 authorizes payments by Milk Boards to registered producers in respect of milk sold at a reduced price (as in the present experimental schemes in certain parts of the Special Areas), if arrangements to that effect are approved by the Minister.

Wheat Act, 1932. *Sales of Home-Grown Wheat, Cereal Year, 1936-37.* Certificates lodged with the Wheat Commission by registered growers during the period August 1, 1936, to August 7, 1937, covered sales of 23,552,914½ cwt. of millable wheat as compared with 33,588,020 cwt. in the corresponding period (to August 7) in the preceding cereal year.

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Byelaws of the Wheat Commission. The Minister and the Secretaries of State for Scotland and the Home Department have made the Wheat Commission (Approval of Byelaws) No. 10 Order, 1937 (S.R. and O. 1937, No. 745), approving two additional Byelaws, Nos. 28A and 35A to be read as one with the Wheat Byelaws, 1932. The purpose of these additional Byelaws is to enable the Wheat Commission to give effect to the provisions of Section 7 of the Agriculture Act, 1937, that if, in respect of any farm, any person elects to avail himself of the oats and barley subsidy, then no deficiency payments are to be payable under the Wheat Act, 1932, in respect of any wheat harvested in that year and grown on land which, at any time during the first eight months of that year, was comprised in that farm. The new Byelaws provide for a special form of declaration to be made by registered growers in respect of wheat certificates issued in August and September of this year, and for various amendments in the form of wheat certificates issued after September 30, 1937. Copies of the Order can be obtained—price 3d., net—from the Stationery Office or through any bookseller. Copies of the new Byelaws and of the Wheat Byelaws, 1932 (the latter, price 6d. post free), may be obtained from the Wheat Commission, 10, Smith Square, London, S.W.1.

Ascertained Average Price of Home-Grown Millable Wheat in 1936-37. After consultation with the Wheat Commission, the Minister has made the Wheat (Ascertained Average Price) Order, 1937, (S.R. & O. 1937, No. 780) certifying and prescribing that, during the cereal year ended July 31, 1937, registered growers sold 23,700,000 cwt. of millable wheat of their own growing at an average price of 8s. 9.92d. per cwt.

Sugar Industry (Reorganization) Act, 1936. Assessment of Refiners' Contributions to British Sugar Corporation, Ltd. The Minister has made the Sugar Refining Agreement (Assessment of Contributions) Scheme (Approval) Order, 1937 (S.R. & O. 1937, No. 771) approving a Scheme submitted to him by the Sugar Commission under Section 9 (1) of the Sugar Industry (Reorganization) Act, 1936. The Scheme provides for the assessment of contributions to be made under the Sugar Refining Agreement dated February 22, 1937, to the British Sugar Corporation, Ltd., by other registered refiners, and for the payment to the Corporation of such contributions; the Scheme comes into force on September 1, 1937.

MARKETING NOTES

Proposed Beet-Sugar Factory at Pembroke. In reply to a question in Parliament on July 29, the Minister announced that the Sugar Commission had informed him that, after careful investigation, it had reached the conclusion that the erection of a beet-sugar factory in Pembroke would not be justified on economic grounds. The Minister added that in the light of this advice, and after communicating with the Commissioner for the Special Areas (England and Wales), he did not consider that any useful purpose would be served in examining this project further.

Cattle Fund. The following table gives particulars of payments made under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936:—

Period		Payments £	Animals	Average payment per animal	
				£	s. d.
April to July, 1935	..	1,240,457	524,484	2	7 0
April to July, 1936	..	1,276,892	548,406	2	6 6
April to July, 1937	..	1,267,041	542,502	2	6 8
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*September 1, 1934 to July 31, 1937	..	11,146,953	4,710,286	2	6 10

* Commencement of Subsidy payments.

National Mark Trade Committees. The duty of advising the National Mark Committee and the Minister on matters relating to both the National Mark Egg Scheme and the National Mark Dressed Poultry Scheme was originally entrusted to the National Mark Egg and Poultry Trade Committee. In view of developments which rendered it desirable that there should be a Committee for each Scheme, the National Mark Egg and Poultry Trade Committee was recently dissolved and the Minister of Agriculture and Fisheries has now appointed separate Committees as follows:—

NATIONAL MARK EGG TRADE COMMITTEE:

Mr. A. F. Forbes, C.A. (Chairman); Mr. S. Street Porter, Mr. W. B. Bradley and Mrs. L. K. Huxley, O.B.E. (representing producers); Mr. T. Robinson, Mr. S. G. Shaw, and Mr. J. McFadyen (representing distributors); Mr. F. G. Swan (representing packers); and Mr. E. T. Halnan of the School of Agriculture, Cambridge.

NATIONAL MARK DRESSED POULTRY TRADE COMMITTEE:

Mr. A. F. Forbes, C.A. (Chairman); Mr. W. B. Bradley, Mr. P. Hedworth Foulkes, B.Sc., Mr. Oliver Powell and Mr. Leshe Sorrell (representing producers); Mr. A. S. Juniper, Mr. C. Percy Keevil and Mr. J. McFadyen (representing distributors); Mr. W. W. Waite, M.B.E. (representing retailers); and Mr. C. Crowther, M.A., Ph.D., Principal of Harper Adams Agricultural College, Newport, Shropshire.

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National Mark Dressed Poultry. Full details of the output of authorized stations during the half-year ended June 30, 1937, are not yet available, but the returns received to date show that over 160,000 birds have been packed under National Mark labels as compared with 104,000 birds during the corresponding period of 1936. It is noteworthy that this increase in National Mark output has been achieved in spite of the fact that the number of authorized packers decreased from 36 in 1936 to 32 in 1937.

National Mark Publicity. A National Mark Exhibition will be held at Exeter during the period September 15-24, with the co-operation of the civic authorities.

The Ministry will stage an appropriate exhibit at the National Honey Show to be held at the Horticultural Hall, London, from September 1-4; and at the Grocers' Exhibition in the Royal Agricultural Hall, London, a comprehensive range of National Mark products will be displayed and samples will be on sale during the period September 18-24. A full range of the Ministry's publications will be on sale at each show.

SEPTEMBER ON THE FARM

R. W. WHELDON, D.Sc.,

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At the time of writing harvesting is in full operation in the south of England, and if good weather continues little will be left uncartered in September. In the north of England, however, a start has not yet been made on most farms. On the whole there is perhaps less laid corn than usual, although in the Fens, particularly round Boston, heavy rain laid many crops at the end of July, with the result that harvesting will be a most laborious business. Oats appear to be the disappointing cereal of 1937, crops frequently being much below the average. Oat straw for fodder will be short on many farms, and it is fortunate that the hay crop is abundant and has commonly been secured in good condition.

Our Grass Land. Readers will have learned from the press of the meetings of the International Grassland Congress in Great Britain during July. Such meetings are most valuable. Not only is much valuable information made available at the fixed meetings when specialists deal with various aspects of grassland management, but an excellent opportunity is afforded for delegates to discuss many of the problems during the time they spend together while visiting different parts of the country.

As one takes account of grass land in the country one is impressed with the magnitude and many-sided nature of the problems involved. Ranging from the hill and mountain pastures of low productivity, yielding in many instances less than 40 lb. of live-weight increase per acre per annum, where questions of the most suitable grazing stock with ability to live and thrive on poor pasturage and under adverse conditions of climate and disease are perhaps first considerations, to areas of high production involving suitable seeds mixtures, considerations of the most productive strains of plants, manuring and management, there is surely a wide field for chemists, botanists, veterinarians and agriculturists.

The productivity of very large areas of hill land can no doubt be greatly increased as far as pasturage is concerned, but the economic aspect needs to be carefully considered before much expenditure is undertaken. In a large number of

instances, if our hill land produces more pasturage, cattle need to be grazed in addition to sheep, as there is a limit to the number of sheep that can be maintained in health. Where cattle are involved in a farming system the provision of suitable winter keep has to be considered, and it is frequently very difficult to provide this on hill farms. Suitable winter accommodation for cattle is often lacking on such farms, the provision of which involves considerable expenditure.

There are very large areas of enclosed land, much of which was at one time under the plough, with buildings and accommodation for livestock, which are capable of greatly increased productivity. Economic improvement of such areas is often possible, and the provision of the necessary winter keep is a practical proposition. It seems necessary to stress the importance of making provision for a corresponding increase of available winter food if we are to cash the increase in the quality and quantity of our improved pastures. On grass farms the improvement of the permanent hay ground should be considered along with the improvement of pastures. The judicious use of phosphatic fertilizers, and where necessary potash, together with proper grazing management is the sound basis for the improvement of this type of land. The lessons of the Tree Field and Hanging Leaves plots at Cockle Park still play a most important part, in fact they give the key to the improvement of grass land. This work needs to be, and has been, carried further, but if the principles worked out on these fields and on the Palace Leas hay plots were applied more generally a great increase would be obtained from our grass land.

Increased output from pastures means increased capital in grazing stock. It is not wise to attempt the former unless there is preparedness to follow up with the latter. The specialist considers and stresses his particular section, but the successful farmer must always have the whole problem before him and maintain a correct balance in relation to each aspect, whether it be manuring, grazing management, disease, type of animal or market requirements.

Grazing of Aftermath. After the hay crop has been removed from both temporary and permanent hay ground an abundant growth of succulent aftermath is frequently obtained in a favourable season. In most areas it is desirable that this autumn-grown grass should be consumed in the early part of

SEPTEMBER ON THE FARM

the winter. If left uneaten it is usually cut down by frost, is largely wasted, and the uneaten herbage forms a mat on the surface of the soil, thus producing harmful conditions for the next year's crop. While aftermaths provide a "change" and clean ground for sheep, the feeding value is not so good as that of corresponding pasture land, and at this season of the year there is a falling off in the feeding value of grass land generally. Milk producers know how yields fall, even where grass is abundant, unless some compensation is given in the way of additional concentrates. Every effort should be made to maintain milk yields at this season of the year, as any falling off in yield is not easily recovered during the winter. In the autumn there is a natural tendency for cows to fall in yield. Efficient milking as well as attention to feeding should be particularly watched at the present time.

Early Winter Beef. It is sometimes said that "a week's feeding in the yards in September is worth two in November." Where the object is to have beef animals ready for the early winter market it is an advantage to put them into the yards in good time. The rate at which animals put on flesh when on grass alone in October is much slower, and it takes some time to settle down when they are brought indoors. A careful watch should be kept on animals intended for early fattening, to see that they do not mark time at this season of the year. Cattle look bulky and appear to be putting on weight, when quite frequently there is very little gain. In the autumn animals grow more hair, and with a lot of bulky feed they have an air of well-doing, which is more apparent than real. Suckled calves should be taught to take trough food where this can be done. If they have been accustomed to concentrates before weaning they do not suffer the same check as when they have to be taught to eat after weaning. The advantage of weaning in good time is two-fold: the weather is better for the calves, and the dams have a little time to recover from the weaning period before the weather becomes too severe and are thus better able to withstand the winter, where it is the practice to run out of doors.

Sheep. On many lowland farms the rams are turned to ewes during the month, although on farms where early lambs are required they will have been away for some time already. There is no doubt that it is most important to have lambs

SEPTEMBER ON THE FARM

arriving at a time when the ewes can have sufficient suitable food for milk production. At Cockle Park, for example, it is found that March-born lambs are usually as heavy as February-born lambs at weaning time. By delaying lambing until there is a prospect of more suitable food and better weather conditions there is a considerable saving in keep. Such a farm cannot compete with earlier and more sheltered farms for early fat lamb production. Prolificacy was referred to in the August issue of this JOURNAL, p. 476. Management as well as breed affect the numbers of lambs born. Ewes should be in improving condition without being excessively fat, although poor ewes do not usually produce a heavy crop of lambs. While the hill farmer does not want more than a lamb per ewe he does not want a large proportion of barren or geld ewes. Whatever the conditions it is certainly desirable to have the flock thriving just before and during the tupping season. Flushing can frequently be practised on lowland farms, while a change can sometimes be obtained on hill places. Care should be taken to see that rams are doing their work, and it is desirable not to have too many ewes per ram. If a large number of ewes are in season on one day some may be missed or the number of lambs born may not be so great.

During the month fattening sheep are frequently put on to the root break. Cabbages and marrow stem kale may be available in the south, while soft turnips would probably be used in the north. Sheep usually fatten better on root crops when the crop has reached a fair stage of maturity. It is well recognized that fattening hoggs will make better gains on mature soft turnips in early autumn than on immature swedes. When the root crop is not being cut and trough-fed to the sheep it is not possible to control the quantity consumed, unless daily pens are set. Very satisfactory gains can be obtained when the quantity of roots is controlled and other suitable foods are given. Variety in the concentrate mixture is advantageous, but it is desirable that foods should be well mixed and finely broken.

Where a cereal and high protein cake mixture is fed, a strong sheep that may be master of the trough frequently consumes much more than its share of the protein food, resulting in loss to the others and very considerable danger to itself. Some years ago it was customary to feed much more protein in the ration to fattening sheep than is now common. A mixture containing four parts of cereals to one part of a rich protein

SEPTEMBER ON THE FARM

cake is now in common use in the north of England. Fewer deaths have occurred amongst the fattening sheep since the amount of protein was reduced.

Wheat. If opportunity permits much wheat will be sown during the month. Where it can be grown it is the popular cereal. It can be sown successfully over a long period, it is the easiest cereal to harvest, and there is now less speculation as to the price obtainable. While wheat frequently produces a crop when sown under less favourable soil conditions it does pay to put the seed in under the best conditions obtainable. In these days wheat more frequently follows a cereal crop than it did at one time. When this is so it is important that manuring should be provided. If farmyard manure cannot be supplied an autumn application of phosphates and if needful potash should be given. Sometimes a light nitrogenous dressing may also be applied at sowing time to give the crop a start. This would be followed by suitable spring applications. Wheat can stand and usually pays for liberal manuring.

The choice of variety is always an important matter. In districts where rust is common Little Joss is a great favourite. In the north of England, however, this variety is little grown. It yields less and is much more apt to lodge than varieties like Crown, Steel, Wilhelmina and Renown. Quality is a desirable character in any wheat variety, but I do not know any year so far when the heaviest yielding variety did not leave the best return to the farmer in the north of England. The seed rate varies considerably in different parts of the country, the range being from 2 to 4 bushels per acre. Visitors to Cockle Park often express surprise when told that $3\frac{1}{2}$ to 4 bushels is the normal seeding for wheat. Experience has proved that the best crops are obtained from such seedings on this farm. Where physical conditions of soil are poor and winter conditions are unfavourable a thick plant is an advantage.

Looking Forward. Haymaking and harvesting machinery can be put away until 1938. Defects are now known and it is a good plan to have necessary repairs attended to before finally putting away for the winter. Cattle will soon be housed and on to their winter rations. If attention has not already been given to winter concentrates, markets should be considered and necessary provision made. Similarly the winter manuring policy should be worked out so that it can be proceeded with without delay when opportunity permits.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended Aug. 4				
	Bristol	Hull	L'pool	London	Costs per Unit $\frac{1}{2}$
Nitrate of Soda (N. 15½%) ..	£ 8 0c	£ 8 0c	£ 8 0c	£ 8 0c	s. d. 10 4
" " Granulated (N. 16%) ..	8 0c	8 0c	8 0c	8 0c	10 0
Nitro-Chalk (N. 15½%) ..	7 10c	7 10c	7 10c	7 10c	9 9
Sulphate of Ammonia:—					
Neutral (N. 20·6%) ..	7 3c	7 3c	7 3c	7 3c	7 0
Calcium Cyanamide (N. 20·6%) ..	7 5d	7 5d	7 5d	7 5d	7 0
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 0	5 1	4 19	4 17	3 3
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%) ..	8 3	8 8	8 5	8 1	3 3
Sulphate " (Pot. 48%) ..	9 13	10 0	9 17	9 11	4 0
Basic Slag (P.A. 15½%) ..	2 10b	2 2b	..	2 7b	3 0
" (P.A. 14%) ..	2 5b	1 17b	1 17b	2 3b	3 1
Grd. Rock Phosphate (P.A. 26-27½%) ..	2 12a	..	2 10a	2 5a	1 8
Superphosphate (S.P.A. 16%) ..	3 4	..	3 3e	3 0f	3 9
" (S.P.A. 13½%) ..	3 1	2 17	2 19e	2 16f	4 1
Bone Meal (N. 3½%, P.A. 20½%) ..	..	6 10	7 5g	7 2	..
Steamed Bone Flour (N. ½%, P.A. 27½-29½%) ..	5 5h	5 10	5 0g	5 0	..

Abbreviations: N. = Nitrogen: P.A. = Phosphoric Acid:
S.P.A. = Soluble Phosphoric Acid: Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons 5s. per ton extra, and for lots of 1 ton and under 2 tons 10s. extra.

d Delivered in 4-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 4 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons 10s. per ton extra, for lots of 10 cwt. and under 1 ton 15s. extra, and for lots of less than 10 cwt., but not less than 2 cwt., 20s. extra.

e Prices shown are f.o.r. Widnes.

f Prices shown are f.o.r. northern rails; southern rails, 1s. 3d. extra.

g Prices shown are f.o.r. Appley Bridge.

h Price shown is f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent. nitrogen, contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced rate is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Meat Meals. In the feeding of pigs and poultry widespread use is made of the by-products of the slaughterhouse, which are marketed in dried form as meat meal or meat and bone meal. These feeds are not only very rich in protein, usually containing 45-60 per cent. according to grade, but also the "quality" of the protein is such that it tends to correct the quality deficiencies of the proteins of the cereal meals along with which the meat meal is fed. In this latter respect the protein of meat proper, such as is provided by the muscles and glandular tissues (liver, kidney, etc.), is superior to that provided by gristle, connective tissue, skin and bone. This difference is apparent from the chemical make-up of the proteins of these different types of material, and has been confirmed in practical pig-feeding experiments at the Harper Adams College.

The highest quality of meat meal would thus be a product made from pure lean meat, free from fat and bone, and such a product would contain well over 80 per cent. of protein, all of high quality. The presence of connective tissue, skin, etc. (but not bone) along with the meat would not greatly reduce the percentage of protein, but would lower its quality. Such a meal, made from pure meat, with or without connective tissue, etc., though very rich in protein, would be comparatively poor in minerals, and in itself would therefore not be a complete supplement to the cereal meals, which are also deficient in certain minerals, notably lime and salt.

At the other extreme from pure meat meal is pure bone meal, which, after subjecting to the process customary in the manufacture of meat and bone meals, commonly contains about 25 per cent. of protein of lower quality than meat protein, along with a very high proportion of minerals, consisting chiefly of phosphate of lime, this forming about 55 per cent. of the weight of the meal. Any admixture of bone with the meat used for making a "meat meal" will thus tend to lower the proportion and quality of the protein, and to raise the proportion of minerals, especially lime and phosphoric acid.

NOTES ON FEEDING

All commercial "meat meals" are of this character, and include a proportion of bone. Provided the proportion of protein does not fall below 55 per cent., it is legitimate under the Fertilizers and Feeding Stuffs Act for the product to be described as "meat meal," but below this limit the designation of "meat and bone meal" must be used. For the lowest grades on the market "bone and meat meal" would be a more correct description. The operation of the Act has tended to standardize "Meat Meal" at a level of 55-60 per cent. protein, but "meat and bone meals" show a rather wider range, 40-50 per cent.

Another factor that tends to influence the protein content of these meals is the amount of fat remaining in them from the raw materials used. Naturally, the higher the percentage of fat, the lower tend to be the percentages of protein and other ingredients. Within limits, fat may be a very valuable nutrient, but if present in too large a quantity it often tends to impair palatability, to depress the digestibility of the food as a whole, and, even worse, to spoil the quality of the fat in the carcass of the animal that consumes the meal. The last-named point is of particular importance in connexion with the use of meat meals in pig-feeding, and does not receive the attention it requires. It is not uncommon for meals to be sold containing 10 per cent. or more of fat, and there is now direct evidence that the use of such meals, even at a rate no greater than 8-10 per cent. of the total food, may easily produce pig carcasses quite unsuitable for curing.

On the other hand, there is evidence that excessive heat or fat solvents employed to reduce the fat content of the meal to a low point may impair its palatability and digestibility. On this and other points information is available in the results of digestion trials carried out by Woodman at Cambridge, and which are reported in the current issue of the *Journal of Agricultural Science*.

For this work he procured three meat meals of widely differing fat content, made from the same consignment of raw material by three different processes. The first stage of the process was the same in each instance, the raw material (including 10 per cent. of bone) from the slaughterhouse being heated with continuous stirring, in steam-jacketed receptacles up to a temperature of about 245° F. until the material was thoroughly cooked and the moisture content reduced to 5-8 per cent., the time required being usually 4-5 hours. The

NOTES ON FEEDING

molten fat was drained off, and a quantity of the residual material removed for the purposes of the experiments, although normally it would not be marketed at this stage. This material, which contained 18.8 per cent. of fat in its dry matter, formed the "high fat" sample of the experiments.

The rest of the material was pressed in an expeller. This is the customary practice in the trade, having as its object the removal of a further portion of the fat and to produce a substance containing about 9 per cent., which, after milling and bagging, is the normal product offered for sale. The material produced on this occasion contained 11.1 per cent. of fat, and formed the "medium fat" sample.

A portion of this material was then "degreated" at 300° F. by means of petroleum benzine, and left a product containing only 3.2 per cent. of fat, which formed the "low fat" sample of the experiments.

Judged by protein percentage, all the materials were high-grade meat meals, the crude protein content (on dry matter) ranging from 66 to 72 per cent., of which, however, only 50-55 per cent. was true protein. Mineral content ranged from 12 per cent. in the "high fat" sample to 20.9 per cent. in the "low fat" sample.

The results obtained with the three materials in digestion trials with pigs are summarized below:—

PERCENTAGE DIGESTIBILITY

				<i>High Fat</i>	<i>Medium Fat</i>	<i>Low Fat</i>
Total Dry Matter	..	..	..	85.4	88.0	75.3
Organic Matter	..	..	..	88.3	93.1	83.9
Crude Protein	..	..	..	90.9	93.9	87.9
Ether Extract (fat)	..	..	..	95.4	89.0	82.3

Taking "Organic Matter" as a measure of general digestibility, it will be seen that all the samples showed a high digestibility, but with a little advantage to the "medium fat" meal, and an appreciable disadvantage against the "low fat" meal. The same will also be noted with regard to the digestibility of the crude protein. The ability of the pigs to digest the fat of the meat meals, with a high degree of efficiency, will also be noted.

If the verdict be based upon total organic matter and crude protein, it would seem from these results that the grade of meat meal usually sold, the "medium fat" grade, is the most digestible of the three grades tested. The slightly lower

NOTES ON FEEDING

digestibility of the "high fat" sample is undoubtedly due to a depressant effect of the large dose of fat upon the general digestibility of the meal, but for the more marked falling off in digestibility of the "low fat" meal some other explanation is required, and, judging from American experience, is probably to be found in the high temperature to which it was subjected during the extraction process.

Despite the higher digestibility of the "medium fat" meal, one cannot recommend meat meals containing as much as 10 per cent. of fat for the production of bacon pigs, owing to the risk of soft carcass fat. What is needed for this purpose is a meal made from less fatty raw materials. Whether the product obtained by pressure alone is necessarily superior to that obtained by extraction should be tested by further experiments.

Digestibility of Huskless Oats. The digestibility of the ordinary varieties of oats is largely conditioned by the amount and nature of the husk that must of necessity be consumed along with the kernel. Ordinary data for digestibility are thus clearly not applicable to the huskless oat, for which independent data are required in view of the current interest in the growing of this variety. Such data relating to digestion by poultry are available from recent experiments carried out by Moon and Thomas at Armstrong College, and reported in the current issue of the *Journal of Agricultural Science*.

The average results for Victory oats and for huskless oats obtained with two Black Leghorn bantam cockerels receiving oats as their sole food are summarized below:—

PERCENTAGE DIGESTIBILITY						<i>Victory</i>	<i>Huskless</i>
Total Organic Matter	..	..	..	..	..	69·8	86·2
Crude Protein	..	..	..	..	..	77·4	82·2
Ether Extract ("Oil")	..	..	..	..	..	83·5	62·4
Fibre	..	..	..	..	..	8·8	—
N-free Extract ("Carbohydrates")	..	..	..	..	..	76·8	90·8

It will be noted that, as expected, the huskless oat proved to be appreciably more digestible than the ordinary oat, except for the "oil" ingredient. Why the digestibility of the oil should be so much lower in the huskless oat is not obvious, and no explanation is offered in the report.

To obtain a true comparison of the nature of the two oats used, their composition in terms of total and digestible nutrients

NOTES ON FEEDING

is set out below, the percentages throughout being based upon the total dry matter.

	Total		Digestible		Comparison of Digestible Organic Matter	
	Victory	Huskless	Victory	Huskless	Victory	Huskless
Total Organic Matter	96.02	97.99	67.0	84.5	—	—
Crude Protein ..	9.25	14.15	7.2	11.6	10.7	13.7
Ether Extract ..	5.78	5.40	4.8	3.4	7.2	4.0
Fibre ..	10.60	1.93	0.9	—	1.3	—
N-free Extract ..	70.39	76.51	54.1	69.5	80.8	82.3
Ash	3.98	2.01	—	—	—	—

Moisture in Sample : Victory, 14.90 per cent.; huskless, 15.46 per cent.

It will be noted that the huskless oat was much richer in digestible protein and carbohydrates than the Victory oat, but contained just over one-half the digestible oil. These differences are less, however, in the composition of the digestible matter itself, as shown in the last two columns.

The calculated starch equivalents of the two oats as used were 58.1 per cent. for Victory and 70.2 per cent. for the huskless oat respectively, which implies roughly a 20 per cent. superiority of the latter over the former for general production purposes when used in a properly balanced ration.

The mineral content of the huskless oat was appreciably lower than that of the Victory oat, but the difference is probably mainly attributable to the relatively valueless minerals of the husk of the latter, which were not represented in the former.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	10 0	0 8	9 12	72	2 8	1.43	9.6
Barley, Argentine ..	9 8	0 8	9 0	71	2 6	1.34	6.2
„ Persian ..	9 5	0 8	8 17	71	2 6	1.34	6.2
Oats, English, white ..	9 13	0 9	9 4	60	3 1	1.65	7.6
„ „ black and grey ..	9 13	0 9	9 4	60	3 1	1.65	7.6
„ Scotch, white ..	10 3	0 9	9 14	60	3 3	1.74	7.6
„ Canadian No. 2. Western	11 0*	0 9	10 11	60	3 6	1.87	7.6
„ „ mixed feed	9 2	0 9	8 13	60	2 11	1.56	7.6
Maize, Argentine ..	6 18	0 7	6 11	78	1 8	0.89	7.6
„ Gal. Fox ..	6 17†	0 7	6 10	78	1 8	0.89	7.6
„ South African, No. 2 White Flat ..	6 18†	0 7	6 11	78	1 8	0.89	7.6
„ 4 Yellow Flat ..	6 18†	0 7	6 11	78	1 8	0.89	7.6
Peas, Japanese ..	20 15†	0 15	20 0	69	5 10	3.12	18.1
Dari ..	8 15†	0 8	8 7	74	2 3	1.21	7.2
Milling Offals—							
Bran British ..	7 5	0 16	6 9	43	3 0	1.61	9.9
„ broad ..	7 12	0 16	6 16	43	3 2	1.70	10.0
Middlings, fine, im- ported ..	7 10†	0 13	6 17	69	2 0	1.07	12.1
Weatings† ..	8 5	0 14	7 11	56	2 8	1.43	10.7
„ Superfine† ..	8 15	0 13	8 2	69	2 4	1.25	12.1
Pollards, imported ..	7 5	0 14	6 11	50	2 7	1.38	11.0
Meal, barley ..	10 10	0 8	10 2	71	2 10	1.52	6.2
„ „ grade II ..	9 15	0 8	9 7	71	2 8	1.43	6.2
„ maize ..	7 7	0 7	7 0	78	1 10	0.98	7.6
„ „ germ ..	7 10	0 11	6 19	84	1 8	0.89	10.3
„ locust bean ..	7 15	0 5	7 10	71	2 1	1.12	3.6
„ bean ..	9 2	0 17	8 5	66	2 6	1.34	19.7
„ white-fish ..	14 15	2 2	12 13	59	4 3	2.28	53.0
„ Soya bean (extracted)†	9 12	1 9	8 3	64	2 7	1.38	38.3
Maize, cooked, flaked ..	7 17	0 7	7 10	84	1 9	0.94	9.2
Linseed cake—							
English, 12% oil ..	10 2	1 0	9 2	74	2 6	1.34	24.6
„ 9% „ ..	9 10	1 0	8 10	74	2 4	1.25	24.6
„ 8% „ ..	9 5	1 0	8 5	74	2 3	1.21	24.6
Cottonseed cake, English, Egyptian seed, 4½% oil	5 17	0 18	4 19	42	2 4	1.25	17.3
Cottonseed cake, Egyptian, 4½% oil ..	5 10	0 18	4 12	42	2 2	1.16	17.3
Cottonseed cake, decorticated, 7% oil ..	8 12†	1 8	7 4	68	2 1	1.12	34.7
Cottonseed meal, decorticated, 7% oil ..	8 2†	1 8	6 14	70	1 11	1.03	36.8
Coconut cake, 6% oil ..	7 15	0 18	6 17	77	1 9	0.94	16.4

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Ground-nut cake, decorticated, 6-7% oil	9 5*	1 8	7 17	73	2 2	1·16	41·3
Ground-nut cake, imported decorticated, 6-7% oil	8 5	1 8	6 17	73	1 11	1·03	41·3
Palm-kernel cake, 4½-5½% oil	7 12†	0 11	7 1	73	1 11	1·03	16·9
Palm-kernel cake meal, 4½% oil	7 12†	0 11	7 1	73	1 11	1·03	16·9
Palm-kernel meal, 1-2% oil	7 0	0 12	6 8	71	1 10	0·98	16·5
Feeding treacle	5 0	0 8	4 12	51	1 10	0·98	2·7
Brewers' grains, dried ale Brewers' grains, dried porter	6 0	0 11	5 9	48	2 3	1·21	12·5
Dried sugar-beet pulp ..	5 12	0 11	5 1	48	2 1	1·12	12·5
From £5 7s. 6d. to £5 15s. 0d. per ton ex-factory (according to factory).							

* At Bristol.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex-mill or store. The prices were current at the end of July, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 per ton as shown above, the cost of food value per ton is £10. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1·43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 3d.; P₂O₅, 2s. 3d.; K₂O, 3s. 6d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6·2	9 6
Maize	78	7·6	6 18
Decorticated ground-nut cake	73	41·3	8 15
" cotton-seed cake	68	34·7	8 12
(Add 10s. per ton, in each instance, for carriage.)			

The cost per unit starch equivalent works out at 2·25 shillings, and per unit protein equivalent 0·66 shilling. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent Per cent.	Protein equivalent Per cent.	Food Value per ton, on farm £ s.
Wheat	72	9·6	8 8
Oats	60	7·6	7 0
Barley	71	6·2	8 4
Potatoes	18	0·8	2 1
Swedes	7	0·7	0 16
Mangolds	7	0·4	0 16
Beans	66	19·7	8 2
Good meadow hay	37	4·6	4 6
Good oat straw	20	0·9	2 6
Good clover hay	38	7·0	4 10
Vetch and oat silage	13	1·6	1 10
Barley straw	23	0·7	2 12
Wheat straw	13	0·1	1 9
Bean straw	23	1·7	2 13

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d., post free 7d.

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1937

ACREAGE UNDER CROPS AND GRASS AND NUMBERS OF LIVE STOCK ON
HOLDINGS ABOVE ONE ACRE IN EXTENT IN ENGLAND AND WALES
AS RETURNED BY OCCUPIERS ON JUNE 4, 1937.

(The figures for 1937 are subject to revision.)

Crops and Grass

Distribution	1937	1936	Increase		Decrease	
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Per cent.</i>	<i>Acres</i>	<i>Per cent.</i>
TOTAL ACREAGE under all CROPS and GRASS	24,772,000	24,863,000	—	—	91,000	0·4
*ROUGH GRAZINGS	5,435,000	5,433,000	2,000	—	—	—
ARABLE LAND	9,018,000	9,120,000	—	—	102,000	1·1
PERMANENT GRASS:						
For Hay	4,671,000	4,669,000	2,000	—	—	—
Not for Hay	11,082,000	11,074,000	8,000	0·1	—	—
TOTAL	15,753,000	15,743,000	10,000	0·1	—	—
Wheat	1,731,000	1,704,000	27,000	1·6	—	—
Barley	823,000	819,000	4,000	0·5	—	—
Oats	1,222,000	1,420,000	—	—	198,000	13·9
Mixed Corn	92,600	97,600	—	—	5,000	5·1
Rye	16,100	19,200	—	—	3,100	16·1
Beans, for stock feeding or seed	96,900	122,700	—	—	25,800	21·0
Beans, for market or canning ..	13,300	15,200	—	—	1,900	12·5
Peas, for stock feeding or seed ..	34,900	47,000	—	—	12,100	25·7
Peas, for canning or packeting, green or dried	25,200	28,100	—	—	2,900	10·3
Green Peas, for market	45,600	67,700	—	—	22,100	32·6
Potatoes, first earlies	55,200	56,300	—	—	1,100	2·0
Potatoes, main crop, including second earlies	399,900	400,300	—	—	400	0·1
Turnips, for stock feeding or seed	181,800	177,500	4,300	2·4	—	—
Swedes, for stock feeding or seed	242,800	254,800	—	—	12,000	4·7
Turnips and Swedes, for human consumption	15,500	17,000	—	—	1,500	8·8
Mangolds	206,800	246,000	—	—	39,200	15·9
Sugar-beet	306,600	348,700	—	—	42,100	12·1
Kohl Rabi	6,100	5,400	700	13·0	—	—
Rape (or Cole)	55,700	52,000	3,700	7·1	—	—
Cabbage, Savoys and Kale for fodder	84,400	118,200	—	—	33,800	28·6
Cabbage, Savoys, Green Kale and Sprouting Broccoli, for human consumption	38,000	43,700	—	—	5,700	13·0
Brussels Sprouts	32,500	35,000	—	—	2,500	7·1
Cauliflower or Broccoli (non-sprouting)	18,800	20,500	—	—	1,700	8·3
Vetches or Tares	38,400	62,600	—	—	24,200	38·7
Lucerne	34,900	38,100	—	—	3,200	8·4
Carrots	13,900	16,600	—	—	2,700	16·3

* Mountain, Heath, Moor, Down and other rough land used for grazing.

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Distribution	1937	1936	Increase		Decrease	
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Per cent.</i>	<i>Acres</i>	<i>Per cent.</i>
Onions	1,700	1,600	100	6.3	—	—
Mustard for seed	24,100	31,900	—	—	7,800	24.5
Hops	18,100	18,300	—	—	200	1.1
Small Fruit	52,800	55,700	—	—	2,900	5.2
Orchards	258,400	261,300	—	—	2,900	1.1
CLOVER AND ROTATION GRASSES :						
For Hay	1,469,000	1,340,000	129,000	9.6	—	—
Not for Hay	751,000	761,000	—	—	10,000	1.3
TOTAL	2,220,000	2,101,000	119,000	5.7	—	—
BARE FALLOW	533,600	335,000	198,600	59.3	—	—

The preliminary tabulation of the returns made by occupiers of agricultural holdings exceeding one acre in extent in England and Wales on June 4, 1937, shows a similar proportionate decrease (0.4 per cent.) in the total acreage under all crops and grass to that which was recorded in 1936. Rough grazings show an increase of 2,000 acres, while the decrease in the total area of crops and grass amounts to 91,000 acres. The area of arable land continued the decline which had been interrupted in 1935, the total this year being 9,018,000 acres, a decrease of 102,000 acres (1.1 per cent.) from the acreage in 1936. An additional area of about 10,000 acres has been returned as permanent grass, but the remainder of the reduction (91,000 acres) represents the loss to agriculture of land which has gone out of cultivation or has been taken for other purposes. The area under bare fallow has increased by 198,600 acres (59.3 per cent.). On the other hand there have been decreases in the oats area (198,000 acres) and in certain of the fodder crops, which are partly counterbalanced by slight increases in the areas devoted to wheat, barley, turnips and rape. Of the remainder of the crops only turnips for stock feeding and clover for hay show an increase.

Cereals. The wheat acreage which decreased by 68,000 acres in 1936 has regained part of this loss, there being an increase in area of 27,000 acres (1.6 per cent.). The acreage under barley again shows an increase, but the gain of 4,000 acres (0.5 per cent.) is only small compared with the increase of 27,000 acres recorded in the previous year. The acreage under oats which had only varied slightly during the years 1934 to 1936 declined very considerably by 198,000 acres (13.9 per cent.). The areas under mixed corn and rye show further decreases of 5,000 acres (5.1 per cent.) and 3,100 acres (16.1 per cent.) respectively.

Beans and Peas. The areas under all categories of beans and peas show decreases, the chief reductions being in beans for stock feeding or seed, the acreage of which was reduced by 25,800 acres (21.0 per cent.), peas for stock feeding or seed which decreased by 12,100 acres (25.7 per cent.) and green peas for market, the reduction in which was 22,100 acres (32.6 per cent.).

Potatoes. The area under first early potatoes decreased by 1,100 acres, or 2 per cent., but the main crop, including second earlies, showed very little change, the reduction being only 400 acres, or 0.1 per cent. The

AGRICULTURAL RETURNS

acreage returned to the Ministry under potatoes includes all areas of $\frac{1}{2}$ acre and upwards on holdings of over 1 acre in extent, and is accordingly larger than the acreage returned by registered growers to the Potato Marketing Board.

Sugar-beet. The sugar-beet area shows a further decline of 42,100 acres (12.1 per cent.) and is the smallest acreage recorded since 1932.

Roots. The decline in acreage of all root crops recorded last year was continued in 1937, with the exception of turnips for stock feeding and seed, which show an increased area of 4,300 acres or 2.4 per cent. Swedes for stock feeding or seed show a reduction of 12,000 acres or 4.7 per cent., while the mangold acreage was further reduced by 39,200 acres or 15.9 per cent.

Vegetables for Human Consumption. The upward trend in the area devoted to vegetables for human consumption recorded last year has not been maintained. The acreage under cabbages, savoys, green kale and sprouting broccoli decreased by 5,700 acres or 13.0 per cent., brussels sprouts declined by 2,500 acres (7.1 per cent.), cauliflowers and broccoli by 1,700 acres (8.3 per cent.). Carrots also show a reduction of 2,700 acres or 16.3 per cent.

Other Crops. The most important changes in other crops are the decreases in cabbage, savoys and kale for fodder (33,800 acres or 28.6 per cent.), vetches and tares (24,200 acres or 38.7 per cent.), and the increase of 3,700 acres, or 7.1 per cent., in the acreage of rape.

Fruit. The areas under both orchard and small fruit declined by the same amount, viz., 2,900 acres, but the reduction in the small fruit area is 5.2 per cent. and that in orchard fruit only 1.1 per cent.

Clover and Rotation Grasses and Meadow Hay. The decline in the area devoted to clover and rotation grasses last year was arrested by an increase this year in the area to be cut for hay of 129,000 acres (9.6 per cent.). Allowing for the reduction of the area not for hay (10,000 acres or 1.3 per cent.) the net increase under rotation grasses is 119,000 acres or 5.7 per cent. The total area under permanent grass increased by 10,000 acres (0.1 per cent.), the main increase being under grass not intended for hay.

Livestock

Cattle. The total number of cattle in 1937 increased by 73,700 (1.1 per cent.). The chief increases recorded were in cattle under one year old (48,600 or 4.0 per cent.) and cattle one year old and under two years (22,000 or 1.8 per cent.). The only decreases were among cows and heifers in milk which declined by 12,000 (0.5 per cent.) and cows in calf but not in milk which decreased by 11,100 or 2.7 per cent.

Sheep. The total number of sheep shows an increase of 534,800 (3.2 per cent.). Ewes kept for breeding and other sheep under six months old show appreciable increases which more than counterbalance the decreases amongst other classes of sheep.

Pigs. The total number of pigs declined by 171,500 or 4.5 per cent., the reductions being general in all classes.

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	1937	1936	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Cows and Heifers in milk ..	2,215,500	2,227,500	—	—	12,000	0.5
Cows in Calf, but not in milk ..	394,000	405,100	—	—	11,100	2.7
Heifers in Calf	455,600	443,500	12,100	2.7	—	—
Other Cattle :						
Under one year	1,264,400	1,215,800	48,600	4.0	—	—
One year and under two ..	1,273,400	1,251,400	22,000	1.8	—	—
Two years and above ..	1,011,100	997,000	14,100	1.4	—	—
TOTAL OF CATTLE	6,614,000	6,540,300	73,700	1.1	—	—
Ewes kept for Breeding ..	7,316,000	7,237,900	78,100	1.1	—	—
Other Sheep :						
One year and above ..	1,484,800	1,668,600	—	—	183,800	11.0
Over six months and under one year	322,000	437,500	—	—	115,500	26.4
Under six months	8,060,000	7,304,000	756,000	10.4	—	—
TOTAL OF SHEEP	17,182,800	16,648,000	534,800	3.2	—	—
Sows kept for Breeding	455,000	483,200	—	—	28,200	5.8
Other Pigs : Over two months	2,138,900	2,220,600	—	—	81,700	3.7
Under two months	1,038,400	1,100,000	—	—	61,600	5.6
TOTAL OF PIGS	3,632,300	3,803,800	—	—	171,500	4.5
Horses used for Agricultural purposes (including Mares for Breeding)	554,500	561,400	—	—	6,900	1.2
Unbroken Horses (including Stallions) :						
One year and above	100,900	95,900	5,000	5.2	—	—
Under one year	53,700	50,600	3,100	6.1	—	—
Other Horses	149,000	157,700	—	—	8,700	5.5
TOTAL OF HORSES	858,100	865,600	—	—	7,500	0.9
	No. Thousands	No. Thousands	No. Thous.	Per cent.	No. Thous.	Per cent.
Fowls : Over 6 months old ..	24,517	25,362	—	—	845	3.3
Under 6 months old ..	28,038	32,382	—	—	4,344	13.4
TOTAL	52,555	57,744	—	—	5,189	9.0
Ducks	2,281	2,606	—	—	325	12.5
Geese	552	634	—	—	82	12.0
Turkeys	687	707	—	—	20	2.8

Horses. The number of horses, which has declined continuously since 1918, was further reduced in 1937 by 7,500 (0.9 per cent.). Agricultural horses and other horses on agricultural holdings were reduced by 6,900 and 8,700 respectively, but unbroken horses of one year old and above increased by 5,000 and foals increased in number by 3,100.

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Poultry. Considerable reductions in all classes of poultry are recorded this year. Fowls over six months old decreased by 845,000 or 3·3 per cent. and those under six months old by 4,344,000 or 13·4 per cent. Ducks, geese and turkeys show reductions of 12·5 per cent., 12·9 per cent. and 2·8 per cent. respectively.

Agricultural Workers

	1937	1936	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Regular Male Workers :						
21 years old and over	394,800	401,500	—	—	6,700	1·7
Under 21 years old	94,500	100,700	—	—	6,200	6·2
TOTAL	489,300	502,200	—	—	12,900	2·6
Casual Male Workers :						
21 years old and over	57,900	57,900	—	—	—	—
Under 21 years old	7,300	8,000	—	—	700	8·7
TOTAL	65,200	65,900	—	—	700	1·1
TOTAL MALE WORKERS, REGULAR AND CASUAL	554,500	568,100	—	—	13,600	2·4
Women and Girls :						
Regular Workers	46,200	44,600	1,600	3·6	—	—
Casual Workers	30,400	27,900	2,500	9·0	—	—
TOTAL	76,600	72,500	4,100	5·7	—	—
TOTAL WORKERS, ALL CLASSES	631,100	640,600	—	—	9,500	1·5

The steady decline in the total number of agricultural workers since 1933 has continued in 1937, when there was a further decrease of 9,500 (1·5 per cent.), compared with a decrease of 32,600 (4·8 per cent.) in the previous year. The number of casual male workers over 21 years of age showed no change in numbers, but the total for all classes of male workers decreased by 2·4 per cent. Regular male workers over 21 years old showed a decrease of 6,700 (1·7 per cent.) and under 21 years old a decrease of 6,200 (6·2 per cent.). Casual male workers under 21 years old dropped by 700 (8·7 per cent.). The loss of male workers to agriculture has doubtless contributed to the increase in the employment of women by 1,600 (3·6 per cent.) for regular workers. The number of women workers employed for seasonal work increased by 2,500, or 9 per cent.

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The Agricultural Index Number

The general index number of prices of agricultural produce for July is 131 (base July, 1911-13=100), the same as for the previous month but 17 points higher than that recorded for July, 1936. If allowance be made for payments under the Wheat Act, 1932, and the Cattle Industry (Emergency Provisions) Act, 1934, the revised index is 134. Compared with June, average prices of oats, fat pigs, eggs, butter, milk and wool showed a rise, whereas those of wheat, barley, fat cattle and sheep, and potatoes moved downwards.

Monthly index numbers of prices of Agricultural Produce. (Corresponding months of 1911-13 = 100.)

Month	1932	1933	1934	1935	1936	1937
January	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	140
May	115	102	112	111	115	133
June	111	100	110	111	116	131
July	106	101	114	114	117	131
August	105	105	119	113	119	—
September	104	107	119	120	127	—
October	100	107	114	113	125	—
November	101	109	114	113	125	—
December	103	110	113	114	126	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and the Cattle Industry (Emergency Provisions) Act (b).

Month	1932	1933	1934	1935	1936	1937
January	—	111	119	124	125	133
February	—	110	117	122	123	133
March	—	106	112	118	122	134
April	—	109	116	126	128	143
May	—	105	116	117	120	136
June	—	104	114	117	121	134
July	—	104	117	120	121	134
August	108	108	122	120	124	—
September	108	111	125	128	133	—
October	104	112	121	119	129	—
November	105	113	120	119	129	—
December	107	114	120	120	130	—

(a) Commenced August, 1932.

(b) Commenced September, 1934.

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In the following table the monthly index numbers of prices of individual commodities are shown for the months of April to July, 1937, and July, 1936, and July, 1935; base, the corresponding months of 1911-13=100.

Commodity	1937				1936	1935
	July	June	May	April	July	July
Wheat	120	123	124	131	86	68
Barley	127	129	133	132	84	88
Oats	121	120	119	119	83	99
Fat cattle	114	111	112	106	100	93
„ sheep	145	152	160	153	128	117
Bacon pigs	117	114	118	119	113	101
Pork „	115	113	116	117	106	97
Eggs.. ..	144	129	112	112	123	114
Poultry	130	132	122	113	117	120
Milk	175	162	162	215	175	175
Butter	112	109	106	104	100	87
Cheese	128	122	112	109	113	99
Potatoes	142	189	196	191	139	166
Hay	95	98	100	100	82	99
Wool	143	138	141	138	94	86
Dairy cows	115	115	112	112	104	100
Store cattle	120	117	115	109	101	94
„ sheep.. ..	139	132	133	128	113	113
„ pigs	133	127	125	126	126	114

Revised index numbers due to payments under the Wheat Act and the Cattle Industry (Emergency Provisions) Act.

Wheat	123	125	125	131	112	107
Fat cattle	128	125	126	120	114	107
General Index	134	134	136	143	127	120

Grain. At an average of 9s. 8d. per cwt., wheat was 1d. per cwt. lower than in June and the index falls by 3 points. (If the “ deficiency payment ” under the Wheat Act, 1932, is taken into account the figure becomes 123.) Barley at 9s. 6d. per cwt., also showed a reduction of 1d. per cwt., the index, in this instance, declining by 2 points. Oats averaged 9s. 3d. per cwt., compared with 9s. a month ago, and the index moves upwards to a small extent. In July, 1936, wheat averaged 6s. 11d. and barley and oats 6s. 4d. per cwt.

Livestock. During the month under review quotations for fat cattle continued to fall, the average of second quality, at 40s. 8d. per live cwt., being lower by 9d.; owing, however,

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to the base price having decreased by a much larger amount, the index rises by 3 points to 114. The addition of the subsidy under the Cattle Industry (Emergency Provisions) Act, 1934, brings the index up to 128. Fat sheep were again lower in price, and the average of second quality, at 10½d. per lb., was ½d. less than in June, the resulting index declining by 7 points. Baconers, at 11s. 7d., and porkers, at 11s. 10d., per score (20 lb.), showed increases on the month of 6d. and 3d. per score respectively, and the relative indices move upwards by 3 points and 2 points.

Compared with June, dairy cows were slightly dearer but, as a rise of a similar amount was recorded during the base months, the index remains unaltered. On the other hand, store cattle and store sheep were cheaper; owing, however, to a larger downward movement in the base prices of both descriptions, the indices are higher by 3 points and 7 points respectively. The average price of store pigs rose from 29s. 10d. to 30s. 4d. per head, the index advancing by 6 points.

Dairy and Poultry Produce. The regional contract price of liquid milk was increased by 1d. per gallon in July, the index appreciating by 13 points to 175, which is the same figure as that ruling a year ago. Butter averaged 1s. 1½d. per lb., an increase of 1d. per lb. on the month, and the index moves upwards by 3 points. Quotations for eggs were again higher, second quality averaging 14s. 2d. per 120, compared with 11s. 3d. in June; the index shows an advance of 15 points. At £4 5s. 6d. per cwt. cheese was a little firmer in price and the index rises by 6 points, although the latter movement is due principally to the fall of 2s. 6d. per cwt., which took place during the corresponding months of 1911-13. All descriptions of poultry were reduced in price and the combined index is lower by 2 points.

Other Commodities. The average price of the varieties of first early potatoes used in the compilation of the potato index during July and August was £7 18s. 6d. per ton, and compared with £7 14s. 6d. per ton in July, 1936. The index now stands at 142 as against 139 a year ago. Quotations for both clover and meadow hay were somewhat lower, the combined index falling by 3 points. Wool averaged 1s. 6¾d. per lb. or ¾d. per lb. more than in the previous month and the index shows a corresponding advance of 5 points.

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Bee Research at Rothamsted

The Committee of Management of the Rothamsted Experimental Station has appointed Dr. J. Anderson, M.A., B.Sc., as representative of the Scottish Beekeepers' Association on the Bee Research Committee that advises them in regard to investigations on bees carried out at Rothamsted.

Whiteheads or Take-all in Wheat

In the article of the above title by Geoffrey Samuel, M.Sc., which appeared in the June, 1937, issue of this JOURNAL (Vol. XLIV, p. 231), *Alopecurus agrestis* (Black Bent or Slender Foxtail) was inadvertently described as a perennial. Although this very troublesome weed commonly survives through the winter, it is really an annual and has no creeping rhizome.

Farm Workers' Minimum Rates of Wages.—A meeting of the Agricultural Wages Board was held at Kings Buildings, Smith Square, London, S.W.1, on July 26, 1937.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders :—

Cambridgeshire and Isle of Ely.—An Order fixing special minimum rates of wages for male and female workers employed on harvest work during the period of the Corn Harvest of 1937. The rate in the case of male workers of 21 years of age and over is a sum of £12 (instead of £11 10s. as in 1936) to cover a period of four weeks of 64 hours per week (excluding Sunday) and in addition 11d. per hour for any employment on Sundays, and in excess of 64 hours per week. In the case of female workers of 18 years of age and over, the rate is 8d. per hour (as in 1936) for all time spent on the corn harvest.

Essex.—An Order fixing special minimum hourly rates of wages for male and female workers employed on harvest work during the Corn Harvest of 1937. In the case of male workers of 21 years of age and over the minimum rate is 10½d. per hour (instead of 10d. as in 1936) and in the case of female workers of 21 years of age and over 7½d. per hour (instead of 7d. as in 1936) for all time worked on the harvest.

Hertfordshire.—An Order varying the existing minimum and overtime rates of wages, the rates as varied to come into force on August 1, 1937, and to continue in operation until further notice. The minimum rates in the case of male workers of 21 years of age and over are 34s. (as formerly) per week of :—(a) 39½ hours in the weeks in which Easter Monday and Whit Monday fall; (b) 31 hours in the week in which Christmas Day and Boxing Day fall together; (c) 39½ hours in the weeks in which Christmas Day and Boxing Day fall, when these days fall in separate weeks; and (d) 48 hours in any other week, with overtime at 8½d. per hour (as formerly) for all employment on Easter Monday, Whit Monday, Christmas Day and Boxing Day and in excess of the above-mentioned numbers of hours, and 11d. per hour (as formerly) for all employment in excess of 5½ hours on Saturday or other agreed weekly short day and on harvest work during the Corn Harvest. The minimum rates in the case of female workers of 19 years

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of age and over are 28s. (as formerly) per week of the numbers of hours mentioned above in the case of male workers, with overtime at 7d. per hour (as formerly) for all employment on Easter Monday, Whit Monday, Christmas Day and Boxing Day, and in excess of the above-mentioned numbers of hours, and 8½d. per hour (as formerly) for all employment in excess of 5½ hours on Saturday or other agreed weekly short day and on harvest work during the Corn Harvest. Lesser rates are fixed for younger male and female workers, modifications being made in respect of the minimum rates applicable to male workers between the ages of 14 and 21 years and female workers between the ages of 14 and 19 years.

Lincolnshire (Kesteven and Lindsey).—An Order fixing special differential rates of wages for overtime employment of male workers on the Corn Harvest in 1937, the rate in the case of workers of 21 years of age and over being 1s. 3d. per hour (as in 1936).

Monmouthshire.—An Order fixing minimum and overtime rates of wages to come into force on September 16, 1937 (i.e., the day following that on which the existing rates are due to expire) and to continue in operation until March 15, 1938. The minimum rate in the case of male workers of 21 years of age and over is 34s. (instead of 32s. 6d. as at present) per week of 54 hours in summer and 50 hours in winter. The overtime rates for adult male workers remain unchanged at 9½d. per hour on weekdays and 11½d. per hour on Sundays, Christmas Day and Boxing Day. The minimum rate in the case of female workers of 17 years of age and over is 6½d. per hour (instead of 6d. per hour as at present) for all time worked.

Nottinghamshire.—An Order varying the existing minimum and overtime rates of wages, the rates as varied to come into force on August 1, 1937. The minimum rates of wages are in the case of male workers of 21 years of age and over 34s. 6d. (instead of 32s. as formerly) per week of (a) 41 hours in the weeks in which Christmas Day and Good Friday fall; and (b) 50 hours in any other week, with overtime at the rate of 10½d. per hour on weekdays (instead of 9½d. as formerly), and 1s. 0½d. on Sundays, Christmas Day and Good Friday (instead of 11½d. as formerly). Provision is made for an adjustment of the hours in respect of which the minimum weekly wage is payable in the weeks in which Easter Monday and Boxing Day fall to meet cases where holidays are given in those weeks instead of in the weeks in which Good Friday and Christmas Day fall. In the case of female workers of 18 years of age and over, the minimum rate is 5½d. per hour (instead of 5d. as formerly) with overtime at 8½d. per hour (instead of 8d. as formerly).

Suffolk.—(1) An Order cancelling existing minimum and overtime rates of wages for male workers and fixing fresh rates in substitution therefor to come into force on August 1, 1937. The minimum rates in the case of male workers of 21 years of age and over are 32s. 6d. (instead of 31s. 6d. as formerly) per week of 50 hours in summer, except in the week in which Good Friday falls when the hours shall be 41½, and 48 hours in winter, except in the week in which Christmas Day falls when the hours shall be 39½ with, in addition, in the case of horsemen, cowmen and shepherds of 18 years of age and over a sum of 6s. per week to cover employment up to 10 hours per week in connection with the immediate care of animals. The overtime rate for all male workers of 21 years of age and over is 9½d. per hour (instead of 9d. as formerly). (2) An Order fixing special minimum rates of wages for male workers employed in agriculture during the Corn Harvest of 1937. The rate in

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the case of male workers of 21 years of age and over employed on harvest work throughout the harvest period on farms where the total acreage of corn is at least 60 acres is not less than the ordinary minimum rate otherwise applicable with, in addition, a bonus of £5 payable on completion of the harvest period; the hours of work in respect of which this rate is payable are 11½ on any weekday whilst harvest work is in progress. In the case of workers of 21 years of age and over who do not work on harvest work throughout the harvest period or who are employed on farms where the total acreage of corn is less than 60 acres the rate is 10d. per hour for all employment on harvest work.

Enforcement of Minimum Rates of Wages. During the month ending August 12, 1937, legal proceedings were taken against five employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow:—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers involved
		£ s. d.	£ s. d.	£ s. d.	
Staffordshire ..	Leek ..	6 0 0	0 2 0	13 0 7	1
"	Stafford ..	(a)	—	—	1
"	" ..	5 0 0	—	15 0 0	2*
Cardigan-shire ..	Aberayron ..	1 0 0	—	37 19 8	3
Carmarthen-shire ..	Newcastle ..	1 0 0	—	42 10 0	1
	Emlyn ..	1 0 0	—	—	—
		13 0 0	0 2 0	108 10 3	8

(a) Dismissed.

* Case of 1 worker dismissed.

Foot-and-Mouth Disease. No further outbreak of foot-and-mouth disease occurred in the Berwickshire Infected Area. The Area was consequently released from restrictions on July 30.

An outbreak of the disease was confirmed at Broughton, Flintshire, on July 24, and the usual restrictions were imposed over an area of approximately 15 miles radius round the infected premises. The Infected Area covered parts of the counties of Flint, Denbigh and Chester. Eight further outbreaks in the same Infected Area were confirmed between July 25 and August 7, but these outbreaks did not necessitate any extension of the Infected Area, and the disease position remaining satisfactory, the Area was reduced to one of approximately 5 miles round the Infected Premises at West Saltney and at Lower Kinnerton on August 12.

WIRELESS TALKS; SEPTEMBER, 1937

AGRICULTURAL

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National : Sept. 29	6.20	Mr W. S. Mansfield	Farming To-day.
North : Sept. 25	7.55	Mr. H. Lamb	Eyewitness account of the Fell Dales Show.
Midland : Sept. 1	9.0	Mr. E. Moore Darling	Eyewitness account of Kingston Ewe Fair.
„ 9	7.0	Mr. W. A. Stewart	—
West : Sept. 9	9.0	—	Fortnightly letter for Western Farmers.
„ 16	9.05	—	For Western Farmers in particular.
Northern Ireland : Sept. 17	6.0	Mr. P. Fitzpatrick	Farmers' Work and Worry.
„ 25	6.45	—	Talk on the Royal Ulster Agricultural Society's Autumn Show.

HORTICULTURAL

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National : Sept. 3	7.15	Mr. Thomas Hay, M.V.O.	In Other Gardens.
„ 10	7.15	—	In Other Gardens.
„ 17	7.15	Mr. C. H. Middleton	In Your Garden.
„ 24	7.15	Mr. C. H. Middleton	In Your Garden.
Scottish : Sept. 8	9.15	Mr. William Fife	Impression of the Annual Show of the Royal Caledonian Horticultural Society.
North : Sept. 1	8.50	—	Eyewitness account of Harrogate Flower Show.
„ 3	6.25	Mr. W. E. Shewell-Cooper and Mr. J. S. Jackson	Violas and Pansies.
„ 17	6.30	Mr. W. E. Shewell-Cooper	Fruit.
West : Sept. 7	8.10	Mr. D. Harris and Mr. J. Glavin	September Work in the Garden.
Northern Ireland : Sept. 3	8.25	Mr. H. G. Fleet	An Ulster Garden.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

- Gloucestershire** : Mr. F. J. Brooker, N.D.P., has been appointed Assistant Instructor in Poultry Husbandry *vice* Mr. J. N. Charlton.
- Shropshire** : Mr. A. H. Whyte, N.D.A., has been appointed Horticultural Adviser *vice* Mr. G. T. Malthouse; and Mr. R. W. Kemp, N.D.H., has been appointed Assistant Horticultural Lecturer.
- Sussex (East)** : Mr. N. A. Selkirk, B.Sc., N.D.A., has been appointed Resident Lecturer in Agriculture at the School of Agriculture, Plumpton, *vice* Mr. F. J. Williams, N.D.A., N.D.D., who has been appointed Assistant Agricultural Organizer *vice* Mr. B. J. Fricker, N.D.A., N.D.D.

STAFFS OF AGRICULTURAL COLLEGES

- Midland Agricultural College, Sutton, Bonington, Loughborough** : Mr. J. C. Blossom, B.Sc., N.D.A., N.D.D., has been appointed Farm Director *vice* Mr. G. F. Kingston, M.A.
- Miss E. Turner, N.D.D., has been appointed Assistant Dairy Instructress *vice* Miss M. Lumley, N.D.D.
- Mr. S. F. Martin, N.D.D., has been appointed Laboratory Assistant in the Chemistry Department *vice* the late Mr. G. O. Fox.
- Miss E. N. Beard has been appointed Lady Warden.
- Mr. A. R. Wilson, B.Sc., Ph.D., has been appointed temporary Assistant to the Advisory Mycologist for Beet Research.

NOTICES OF BOOKS

Year-book of Agricultural Co-operation, 1937. Edited by the Horace Plunkett Foundation. Pp. vi + 584. (London : P. S. King & Son, Ltd. 1937. Price 15s.)

This excellently compiled publication, now in the ninth year of its present form, has become invaluable to the serious student of agricultural co-operation and marketing, and its appearance is indeed one of the events of the season. In addition to the general survey of the position in the year under review, the present issue comprises comprehensive and scholarly reports from no fewer than thirty-six overseas countries, in all parts of the world, together with a valuable section on the legislation of the year, and an extensive bibliography of co-operation.

The compilers refer to the past year as mainly one of public disquiet and apprehension, yet the co-operative movement not merely holds its own but has begun a tentative advance. The external relations of co-operation with the State are, it is claimed, with certain exceptions, becoming stabilized in a form that on the whole is not disadvantageous to the movement. Note is also taken of a more general drawing together of producers and consumers "for protection and often for more constructive mutual trade and service," and in this connexion the proceedings of the International Committee for Inter-Co-operative Relations are cited, (including as they did a serious inquiry into the dietetic habits of workers). One conclusion is that, whenever agricultural marketing co-operative and distributive societies establish direct economic relations with each other under satisfactorily-managed conditions, they effect further economies to the advantage of both producers and consumers.

The British sections of this annual are mainly concerned with the operations of agricultural co-operative societies registered under the Industrial and Provident Societies Acts and of commodity boards set up under the Agricultural Marketing Acts. A report on the Horace

NOTICES OF BOOKS

Plunkett Foundation reveals that the management has had to carry on with straitened resources since 1932, owing to the cessation of the former grant from the Empire Marketing Board, and to other causes, but that by very strict economy it has been possible to maintain the principal functions of the Foundation, and there is no danger that any essential service will lapse. This is important, for it is held that co-operation in all its forms has still an essential part to play even in a world where State regulation has entered far into fields once allocated to voluntary association.

The Plant Diseases of Great Britain: A Bibliography. Compiled and annotated by G. C. Ainsworth, B.Sc., Ph.D. Pp. xii + 273. (London: Chapman and Hall, Ltd. 1937. Price 15s.)

Most plant pathologists are familiar with the series of reports, issued by the Ministry from time to time during the last twenty years, on the annual occurrence of fungus and other diseases of crops in this country. Dr. Ainsworth has taken most of the diseases referred to in these reports, together with all the important tree diseases, and has collected together some 1,500 references to the more modern literature dealing with them. The hosts are arranged in groups, such as cereals, vegetables, ornamental plants, etc., and the diseases, each with its appropriate literature, are listed under each host. Two good indexes are provided, one of authors and one of hosts and parasites.

The literature references are not intended to be complete, but with very few exceptions they have been so well chosen that they provide a comprehensive list of all the important papers on plant diseases published in this country during the last three decades. Reference is also made to certain foreign papers of special interest and to those that have a direct bearing on diseases occurring in Great Britain. The contents of many of the papers are briefly indicated, and a reference is given to abstracts of them in *The Review of Applied Mycology* issued by the Imperial Mycological Institute.

Where possible, the common name assigned to a disease, and the scientific name of its causal agent, have been taken from the *List of Common Names of British Plant Diseases* compiled by the Plant Pathology Committee of the British Mycological Society, but the author has taken the law into his own hands and used small initial letters for all specific names of pathogens. The nomenclature adopted for viruses and virus diseases is particularly helpful, although the accepted name Spotted Wilt, is scarcely appropriate for some of the diseases of ornamental plants caused by the tomato Spotted Wilt virus. Occasionally a note is inserted indicating the comparative rarity of a disease, but such notes are unfortunately all too few, and it would have added immensely to the value of the book if an attempt had been made to indicate, however briefly, the distribution and economic significance of the large number of diseases included. Some of them might well have been omitted on account of their extreme rarity, and one would have liked to see a more critical attitude adopted towards such diseases as Root Rot of asparagus, Black Mould of onion, Root Rot and "Cauliflower Disease" of strawberry, and Root Rot of viola. Nevertheless, as Dr. E. J. Butler states in his foreword to the book, Dr. Ainsworth's task has been faithfully performed, and plant pathologists will find the volume a mine of information about the plant disease literature of this country.

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NOTES FOR THE MONTH

Grassland Improvement Campaign

Broadcast by the Minister of Agriculture

On September 29 the Rt. Hon. W. S. Morrison, Minister of Agriculture and Fisheries, broadcast a talk to farmers on the National wavelength, in which he dealt exclusively with the subject of the improvement of grass land. This talk was the first of the Winter Series for which Mr. W. S. Mansfield, Director of the University Farm, Cambridge, will be responsible. In introducing the Minister to listeners, Mr. Mansfield said that he was only too well aware that in the past grass land had suffered from the neglect of all concerned, not only of farmers, but of agricultural research workers and politicians as well.

The Minister, in his address, emphasized that British grass land constitutes a most important natural reserve of fertility, and one capable of considerable expansion. No effort should be spared, he said, to build up that reserve until it stands at the highest level that can be reached. Unfortunately, it was true that circumstances outside the farmer's control had led to a large proportion of grass land becoming more or less impoverished. The fact that times are better for the livestock industry, and that lime and basic slag can now be purchased relatively cheaply, combined to make the moment opportune for the initiation of a Grassland Improvement Campaign. In that Campaign, continued Mr. Morrison, the Ministry was enlisting the active co-operation of County Education Authorities and of the Advisory Centres throughout the country. He assured farmers that they were going to hear a very great deal about grassland improvement during the coming winter, both over the wireless and in other ways. A manifesto setting out briefly the case for grassland improvement, the chief methods of

NOTES FOR THE MONTH

improvement, and a few of the more important facts about lime and basic slag, had been published by the Ministry for wide distribution among farmers, and he hoped that every farmer would read this document and give it very careful consideration.*

Concluding, the Minister said that, however vigorously or efficiently the Grassland Improvement Campaign was conducted, the real measure of its success would depend on the farmers. He appreciated that farmers were less likely than probably any other group to be moved simply by propaganda, be it ever so well organized. Quite naturally, he said, they had got to be convinced that a certain policy was the right one, and that it would pay them to follow it. Many of them had been convinced already, and he relied on their example to bring over the doubters and unbelievers. In the ordinary way no Government liked spending money, but he assured listeners that the more the Ministry was required to contribute to the purchase of lime and slag during the next few years, the better they would be pleased, for it was known that lime and slag were good for the land. "It is because we feel that judicious expenditure on grassland improvement is a good investment for the farmer and for the nation as a whole that I am making this appeal to-night for your co-operation and support."

* * * * *

Both on the National wavelength and in the Regional broadcast talks for farmers, grassland improvement will occupy a prominent place during the coming winter. It is hoped that this widespread broadcast appeal will bring to the notice of farmer listeners throughout the country the practical experience of those who have improved their grass land and found that it paid them to do so. The offer of lime and slag at cheap rates is an additional reason why farmers should give serious attention to the condition of their pastures. As indicated by the Minister, the active co-operation of Local Authorities for Agricultural Education—which in practice means the County Agricultural Organizers and their staffs—has been invoked, so that by one means or another the Campaign that he initiated on September 29 may be carried on throughout the country, and in particular so that advisory work amongst farmers, designed to help them in any case of doubt to improve their grass land in the most economic way, may be pursued with

* See page 619.

NOTES FOR THE MONTH

vigour. The Ministry believes that this appeal to Local Authorities will receive a cordial response. In addition the provincial Agricultural Colleges and University Departments of Agriculture have been asked to do their utmost to support the Campaign. This applies particularly to the provincial Advisory Chemists, whose analytical laboratories are already becoming overburdened with the rush of soil samples sent in for testing for lime requirement. This fact in itself reveals the great interest that farmers are taking in the question of soil improvement, and is an indication that the success which the Minister hopes will follow the Grassland Improvement Campaign will, in fact, materialize.

The Two Smuts of Wheat

More inquiries than usual have been received this year concerning the presence of Loose Smut in wheat crops, and a number of farmers have asked why smut should have appeared in crops grown from treated seed. There is evidently still some confusion with regard to the manner of infection and the treatment necessary for the two different smut diseases that affect wheat. Since chemical seed treatments that will control Bunt (Stinking Smut) are of no value in controlling Loose Smut, it is important that the differences between the two diseases should be understood.

Loose Smut is the first smut to become noticeable in a crop, since the ears of affected plants are reduced to a black powdery mass about the time the wheat comes into flower. It is at this time that blossom infection of the grain in neighbouring ears takes place, which will give rise to Loose Smut in the crop grown from the seed the following year. There is only one treatment that can be applied to cure seed affected by this disease. This is the hot-water treatment, that depends upon the fact that the smut fungus, which is present within the embryo, is killed at a slightly lower temperature than the wheat grain itself. Actually the seed wheat must be immersed for ten minutes in hot water, the temperature of which is accurately maintained between 52° C. and 54° C. (125° F. and 129° F.). These limits are very narrow, and if the temperature falls below 52° C. the fungus will not be killed, and if it rises above 54° C. the wheat grain will be injured. Further precautions, which cannot be detailed here, are also necessary. The treatment is therefore one that is too difficult for the farmer to carry out himself. In certain of the United States where

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the disease is prevalent, community treatment plants have been established at dairies and canneries, where suitable apparatus for temperature control is available.

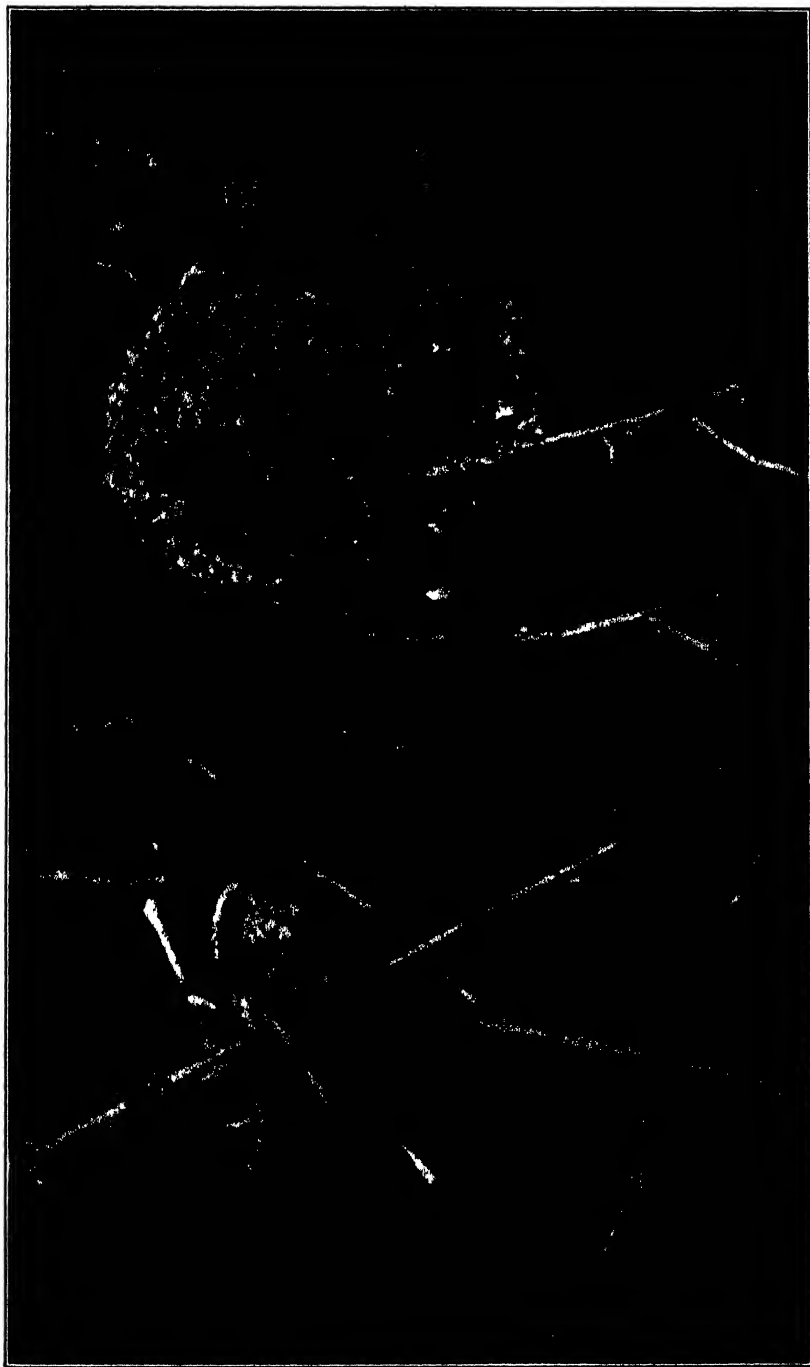
In England, Loose Smut has hitherto not been so severe that the hot-water treatment has had to be used, except in isolated instances. The usual methods of selection of seed wheat have been sufficient to keep the disease within relatively small proportions. Several observers, however, consider that there has been a slow but definite increase in the incidence of the disease within the last few years, and the time may come when the hot-water treatment will have to be applied, at least to nucleus seed stocks to free them from the fungus. Meanwhile, seed should be saved only from crops as free as possible from Loose Smut.

Bunt is the other familiar smut of wheat. In this disease the spores from broken "bunt balls" contaminate the outside of healthy grain, and infect the young seedling plants just when the seed is germinating. This smut can therefore be controlled by seed treatment, either with wet pickles such as formalin, or with dry dusts such as copper carbonate or the proprietary dusts containing organic compounds of mercury. These treatments for Bunt, however, are well known and no further reference to them here is necessary.

Interesting Birds: (8) The Long-tailed Tit

The name of this beautiful little bird is, in itself, almost sufficient description, and the bird is hardly likely to be mistaken for any other British species. It is fairly common in most English counties, and is especially partial to woodland. It is known by a variety of local names, among them "Bottle Tit," "Long Tom," "Feather Poke," and "Mumruffin."

The nest of the Long-tailed Tit is a real work of art, and is easily the most beautiful to be found in this country. It is oval in shape, and has a small entrance hole in the upper part of its side. It is composed of moss, grass, wool and spiders' webs, cleverly felted together, and is invariably lined with feathers, as many as 2,000 of these having been found in a single nest. Favourite sites are thick thorn-bushes, brambles and furze. The eggs are white, lightly speckled with red, but quite plain eggs are not uncommon. The usual clutch is from 10 to 12, but as many as 17 have been found in one nest. It is possible that these larger clutches are the produce of more than one hen bird, and on several occasions three adult birds



Photograph Copyright by Eric J. Hosking.

The Long-tailed Tit at Nest.

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Notes for the Month

have been seen feeding one brood of young. Up to the time the young leave the nest, the parent birds "sleep in," and, small though the birds are, it is something of a mystery how the whole family finds room. When incubating her eggs, the hen sits with her tail doubled back over her head, and one may often see a tail protruding from the entrance hole of a nest.

The food of the Long-tailed Tit consists very largely of insects and their larvae, with the addition of wild seeds of various kinds. The bird is one of the most useful that we have, and, like all the tits, should be encouraged and protected.

Agriculture Act, 1937: Land Drainage

Under Part III of the Agriculture Act, 1937, the Minister is empowered to make grants, out of moneys provided by Parliament, towards the cost of land drainage schemes undertaken by Drainage Authorities in England and Wales (other than Catchment Boards), such authorities including all County Councils, and those County Borough Councils, having Agricultural Committees. The object of these grants is to contribute towards the increased productivity of the soil by encouraging the promotion of schemes for the improvement of land in need of proper arterial drainage. The grants made during the past seven years under the Land Drainage Act, 1930, have been available only in respect of schemes carried out by Catchment Boards on the main rivers for which they are responsible, but under the new programme it will be possible for State-aid to be given in the case of schemes carried out for the improvement of the smaller arterial watercourses, main drains, etc., as was the case almost continuously up to 1931. The grants available will be at the fixed rate of 33 $\frac{1}{3}$ per cent. for ordinary drain clearing work and 50 per cent. in the case of schemes or portions of them involving the provision of machinery or expensive material. All schemes require the Ministry's approval in the first instance, and will be confined to the period October 15 to April 30. The facilities will be available for three winters, with the possibility of extension for two further winters.

Where the necessity for schemes arises within a Drainage District, such schemes will be in the hands of the Drainage Board or Drainage Authority concerned, but County Councils and those County Borough Councils with an agricultural committee will be able to organize voluntary schemes outside Drainage Districts among landowners and farmers, who in such cases

NOTES FOR THE MONTH

should get in touch with the Council affected. It is not intended that grants will be available for schemes of field drainage, or even for arterial drainage schemes designed to benefit only one holding.

Circulars announcing these facilities have been addressed to all concerned, and a number of schemes have already been submitted to the Ministry for approval.

Eradication of Bracken: Demonstration Scheme

The Ministry has recently advised Local Authorities in England and Wales in districts that are infested with bracken that it will provide financial assistance for the demonstration, by the county agricultural education staffs, of the efficacy of approved types of cutting or crushing machines for the eradication of bracken.

Under the scheme, the Authorities concerned will carry out demonstrations, on heavily-infested land in their areas, of the use of machines for cutting or crushing bracken, at appropriate seasons, over a period of two or three years. The only cost to the occupiers of the land on which the demonstrations are conducted will be that of the supply of the necessary power and labour for the operation of the machine used.

It is anticipated that when these demonstration schemes have been in operation for three years the demonstrations will have served to create a demand for the machines, which will then be available for hire from the Local Authorities at economic rates.

Inquiries relating to these demonstrations should be addressed to the Agricultural Organizer of the County in which the inquirer lives.

National Rat Week, November 1-6, 1937

National Rat Week begins this year on Monday, November 1, and the Ministry appeals to all concerned to make every effort during that week to destroy rats and mice and to take all possible steps to secure concerted action to bring them under control.

The Rats and Mice (Destruction) Act, 1919, requires every occupier of land or premises to take steps to destroy any rats or mice on his property and to prevent the property from becoming infested. Some 728 local authorities in England and Wales are responsible for the enforcement of the Act in their respective areas, and the Ministry has addressed a circular letter to these authorities inviting their co-operation in this

NOTES FOR THE MONTH

year's campaign and making suggestions regarding special measures that may be taken in connexion with rubbish dumps, sewage farms, and other properties that are particularly subject to infestation.

In order to assist in the campaign the Ministry has arranged for local authorities to be supplied with copies of an illustrated "National Rat Week" poster and of literature on the subject of rat destruction, and has also offered to lend copies of its cinematograph film "Your Enemy the Rat" illustrating the depredations of rats and the means for their destruction.

The Ministry's Advisory Leaflet No. 49 on the "Destruction of Rats and Mice" contains much useful information and advice, and a copy of this Leaflet, together with a pamphlet that makes simple suggestions for rat destruction and a list of firms from whom poisons, etc., are obtainable, may be obtained free of charge on application to the Ministry.

Further information on the subject is contained in the Ministry's Bulletin No. 30 "Rats and How to Exterminate Them," copies of which are obtainable through any bookseller, or direct from His Majesty's Stationery Office, price 6d. (7d. post free).

Diseases of Animals in 1936

The Report of Proceedings under the Diseases of Animals Acts for the year 1936, recently issued,* opens with a brief outline of the Government's scheme for the inauguration of a large-scale campaign for the eradication of diseases of animals in Great Britain. Part I of the Report describes the incidence of the notifiable contagious animal diseases, and records the continued absence of the following diseases from Great Britain, namely:—cattle plague (rinderpest), pleuro-pneumonia of cattle, sheep pox, rabies, glanders or farcy, epizootic lymphangitis and fowl pest. There were 67 outbreaks of foot-and-mouth disease, distributed among 12 English and 2 Welsh counties; 62 of the outbreaks occurred after October 10, and 40 of these were due to the distribution of infected animals through two markets. This disease continues to be dealt with by the slaughter policy, which involves the immediate compulsory slaughter of all affected animals and of those directly exposed to infection. There was a decrease of 176 (9 per cent.) in the number of outbreaks of swine fever as compared with the

* Report of Proceedings under the Diseases of Animals Acts for the year 1936; H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price net 1s. 6d. (by post, 1s. 8d.).

NOTES FOR THE MONTH

previous year, and a further satisfactory decline (46.5 per cent.) in the number of outbreaks of sheep scab, the total figure, 255, being the lowest recorded for 32 years. On the other hand, the confirmed cases of anthrax showed an increase of 21 per cent. and there was a slight increase in the number of outbreaks of parasitic mange in equines.

The usual details are given showing the results of the administration of the Tuberculosis Order of 1925 by Local Authorities. The number of cattle examined in Great Britain by veterinary inspectors was 438,267 on 26,744 premises, and the number of cattle slaughtered increased by 1,479 to 23,716. The Tuberculosis (Attested Herds) Scheme continued to make steady progress during the year and showed signs of rapid development at the close of the year.

This Part of the Report also describes the three new Orders issued under the powers conferred by the Diseases of Animals Act, 1935, for dealing with poultry diseases, and the general principles governing action in relation to poultry.

Part II of the Report deals with the measures taken to prevent the introduction and spread of disease in this country. It gives particulars of the animals imported from Ireland and other countries and of the instances of disease found in imported animals, these instances being limited to one case of bovine tuberculosis and 99 cases of sheep scab—30 from Northern Ireland and 69 from the Irish Free State.

Part III describes the administration of the measures for the protection of animals from unnecessary suffering during transit by land or sea. The proportion of casualties among the large number of animals carried from Ireland fell to 16 per 100,000, the lowest figure yet recorded.

Part IV deals with the certification of exported pedigree and other livestock and of raw animal products, to comply with the regulations of the importing countries, where such certification has to be made under the Ministry's authority. The record number of 788 animals passed through the London Quarantine Station.

Part V contains a reference to the annual meeting of the International Veterinary Bureau in Paris, and a report of the operation of the Warble Fly (Dressing of Cattle) Order of 1936.

The volume includes a separate report by the Director of the Ministry's Veterinary Laboratory and Research Institute at Weybridge, describing the diagnostic and research work carried out at that Institution during the year under review.

NOTES FOR THE MONTH

The Appendices to the Report contain the usual statistics as to animal diseases, the livestock population, animals imported and exported, and the incidence of certain animal diseases in European countries, together with a memorandum describing the action taken by the Ministry under the Diseases of Animals Act, 1935, in regard to the control of poultry diseases.

Land Drainage Act, 1930, Report

The Ministry has recently issued a Report on the operations and proceedings under the Land Drainage Act, 1930, from the date of the passing of that Act (August 1, 1930) to March 31, 1937.

The Report gives a full account of the functions imposed upon the Ministry under the Act, and the extent to which they have been exercised. It also deals with the activities of Catchment Boards, and includes a brief account of the more important improvement schemes being carried out by these Boards with the aid of Government Grants under Section 55 of the Act. The Report also contains information with regard to the making of by-laws by Catchment Boards, with the Board's powers of control over their main rivers and with the lowland reorganization of the various catchment areas. In addition, it deals with the provisions of the Act in relation to the revenue of Catchment Boards, the powers of Drainage Boards (other than Catchment Boards), and the powers of County and County Borough Councils. Various appendices are included showing the relative positions of the catchment areas as regards size, rateable value, length of main river, lowland reorganization, etc.

The Report appears in a striking cover showing a photograph of a flooded area, taken from the air, and it is hoped that it will prove of interest to all Authorities concerned with the administration of the Act. It has been published at the price of 1s. 6d. net (1s. 8d. post free), and copies are obtainable from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller.

Agricultural Wages (Regulation) Act, 1924: Report of Proceedings, 1935-36

The Ministry has recently issued a Report of Proceedings under the Agricultural Wages (Regulation) Act, 1924, for the year ended September 30, 1936. The Report reviews the work of the Agricultural Wages Board and of the Agricultural Wages

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Committees during the period, and contains full details of the minimum rates of wages for agricultural workers as fixed by the Committees. In addition, the Report deals with the results of the investigations made by the Ministry's Inspectors for the purpose of securing the proper observance of the minimum rates, and with the state of employment in agriculture and the demand for labour.

The Report is obtainable through any bookseller, or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, price 1s. net (post free 1s. 1d.).

Cereals for Autumn Sowing

The following Note has been contributed by the National Institute of Agricultural Botany, Cambridge:

At this time of the year farmers find it desirable to consider which among the many available cereal varieties are likely to give the best financial return. The kind chosen varies with soil, climate, and many other factors.

There is a wide choice of good winter wheats, among the best being Juliana, Victor, Wilhelmina, the Yeomans, Holdfast, Little Joss, Steel, Rivett and Squarehead's Master or Standard Red. In respect of baking quality, Holdfast is worthy of special attention, for tests have shown it to be superior to the Yeomans, or in fact any other English wheat.

As regards barley, where winter hardiness is of first importance the ordinary six-row winter is the most satisfactory. Under favourable conditions, Plumage-Archer or Spratt-Archer both withstand normal winters and give good malting samples as well as high yields.

Among winter oats, Grey Winter and Black Winter are the most hardy. On richer soils, Bountiful stands better but is not so hardy. Where extreme winter hardiness is not required, and for very fertile soils, Resistance can be recommended on account of its resistance to lodging, good quality straw and very high yields. The use of the term "White Winter" as a varietal name for oats should be avoided, as it is ambiguous.

Brief particulars of the purposes for which the above varieties are adapted are given in Farmers' Leaflet No. 1 issued by the Institute. Copies can be obtained free of charge from the Institute at Huntingdon Road, Cambridge, or from any County Agricultural Organizer, and inquiries about these or other varieties are always welcome.

BRITAIN'S GRASS LAND MUST BE IMPROVED

Very large areas of our grass land, in both uplands and lowlands, are in a bad state, but can and must be improved. Britain is pre-eminently a grass country, but good grass land can only be maintained with skill and attention.

Grass land is one of the most valuable but least used of our national assets. Much of it, however, is in poor condition, some areas being so poor that their grazing value is almost negligible.

The farmer pays special attention to the growing of his arable crops, studying their need for cultivation and fertilizers, and building up a standard of yield that is a measure of his success. Regarding the appearance and condition of his live stock he also has standards that are closely connected with economic production, and these standards he maintains with great care. Permanent grass, however, is often left to look after itself. The urgent need to-day is that farmers should pay as close attention to their grass as to their arable fields and their live stock.

Poor and neglected grass land is wasteful: it has a very short season of production; its output is of low quality; and *it is continuing to deteriorate*. Low quality grass leads to malnutrition and disease of live stock.

The present is an appropriate time for farmers to consider the advantages of improving their grass land. Just as in business "it pays to advertise," so in farming "it pays to fertilize." *Under the Agriculture Act, 1937, farmers can obtain lime at one-half and basic slag at three-quarters of the cost delivered to their farms.* This is indeed an opportunity for farmers to improve their pastures and make them more profitable.

Rent and overhead charges form the highest items of grass-land costs. By increasing output overhead charges are proportionately reduced. Most of the improvements brought about by the application of basic slag have been made at a very low additional cost in proportion to the increased output.

By lengthening the grazing season or by increasing the nutritive value of his grass the farmer can reduce the net cost of producing meat or milk. He can also shorten the period required for producing lamb or beef.

Grass land from which milk or young stock is being produced

IMPROVEMENT OF GRASS LAND

is in special need of minerals, particularly lime and phosphates—without which the grass deteriorates in quality and feeding value.

Grass may suffer from lack of drainage, lack of aeration, lack of lime, lack of manures. Even if a farmer can do no more, the correction of one of these deficiencies will raise the standard of a poor pasture. The improved quality, even apart from any extra yield, means that the original numbers of live stock obtain better fare. It is now well known to be cheaper to provide extra protein and minerals through the herbage by manuring than by supplementing poor grass by concentrates.

Grassland improvement means better grass, more grass and a longer grazing season; it means more stock, better and healthier stock, and smaller bills for feeding stuffs. This is not mere theory but the experience of farmers who have put their pastures and meadows in good condition.

In the following pages are indicated some of the more important factors in grassland improvement, and notes are given regarding the use of lime and basic slag. More detailed information is contained in the following publications:—

Bulletin No. 35.—Use of Lime in Agriculture. Price 6d. (7d. post free) from H.M. Stationery Office.

Advisory Leaflets Nos. 134 and 239. Free of charge from the Ministry.

A revised edition of Bulletin No. 3 (Improvement of Grass Land) is now in preparation.

When a farmer is in doubt as to procedure he should consult the County Agricultural Organizer.

Methods of Improvement. In improving grass land the following points should be observed:—

1. *Manures* are needed on all worn-out grass. Phosphates improve practically all pastures, and basic slag supplies phosphate in suitable form. Potash is occasionally needed in addition to slag, and when lime, phosphate and potash have been applied in adequate amounts, nitrogen may be used to increase the yield and also produce grass earlier and later in the season than it normally is.

2. If *lime* is needed, as indicated by weeds (e.g., sheep's sorrel), a "mat," or a soil test, it is important that some form of lime should be applied before using other fertilizers.

3. If *bad drainage* is clearly the factor affecting the herbage, as indicated by weeds, or by "poaching" or "plunging" of the land, it is usually a wise policy to attend to the drainage before applying lime or fertilizer.

IMPROVEMENT OF GRASS LAND

4. *Cultivation* by some form of harrowing is very desirable to speed up the action of lime and fertilizers on old grass. The object of cultivating is to remove any hindrance to the spread of clover and good grasses, and to bring fertilizers into direct contact with the soil.

5. To *plough out and re-sow* is often the surest way of getting the best return when the land is not too difficult for cultivation. Good seeds mixtures should be used and carefully sown. The plough can be used without increasing the actual area of arable crops where a long-leys system is practicable.

6. "*Management*" is the deciding factor in the success of any scheme aiming at high production from grass land. Intelligent control and manurial treatment will extend the grazing season, improve the quality of the hay and grazing, provide better winter keep, reduce weeds, and give opportunities for producing valuable home-grown food in the form of grass silage or dried grass.

Lime. Lime is a fundamental improver, without which the soil cannot make full use of the labour and manures applied to it. The fertility of many farms to-day is due to the liming and chalking that took place in bygone years. Failure to keep up this practice has brought land in many districts into a state in which neither grass nor crop can pay for want of lime. In other districts the lime residues in the soil are approaching exhaustion.

Some land is derelict for want of lime; some land needs no lime; every condition between these two extremes can be found. It is often difficult to judge by inspection whether lime is needed and what amount to apply. These questions can be settled scientifically by soil analysis. The Advisory Agricultural Chemist for the particular area is equipped to undertake this work, and farmers who need this service should consult the County Agricultural Organizer.

The Main Types of Grass Land needing Lime are:—

Most grass land in industrial areas, on Coal Measures and Millstone Grit soils, and especially on areas subject to atmospheric pollution or smoke damage.

Matted grass land, especially on light sandy soils, and soils growing such plants as sheep's sorrel, heath bedstraw, creeping bent and Yorkshire fog.

Land on which red clovers are apt to fail.

Most moorland and peaty soils.

IMPROVEMENT OF GRASS LAND

Forms of Lime. Lime may be applied to the soil in several forms:—

- (1) Calcium oxide (CaO), as quicklime or burnt lime, obtainable as lump lime (shell lime or cob lime), ground lime (bagged lime) or small lime (the residue at the kilns after lump lime is picked out).
- (2) Calcium hydroxide (Ca(OH)_2), as hydrated lime or slaked lime.
- (3) Calcium carbonate or carbonate of lime (CaCO_3), as ground chalk, ground limestone or dried carbonate of lime from certain industrial processes.
- (4) Unground natural materials containing calcium carbonate, as lump chalk, limestone dust, calcareous sea sand, shell sand, and marl.
- (5) Waste lime, such as lime sludge from beet sugar factories, waste carbonate of lime from paper works, and carbide waste lime.

Of these materials the first three groups, i.e., quicklime, calcium hydroxide, ground chalk, ground limestone, dried carbonate of lime, and mixtures of these forms, are standardized materials with which a warranty under the Fertilizers and Feeding Stuffs Act must be given on sale. For each material the percentage of calcium oxide (CaO), calcium hydroxide (Ca(OH)_2), or calcium carbonate (CaCO_3) must be given in terms of prescribed methods of analysis, and for Groups 2 and 3 the equivalent amounts of calcium oxide must also be given.

Groups 4 and 5, being untreated natural products or waste materials that vary considerably in composition, do not come under the Fertilizers and Feeding Stuffs Act. Most vendors of these materials are, however, prepared voluntarily to give a statement of their approximate composition, for the information of purchasers.

The unit price of CaO , i.e., the cost of the material delivered at the farm divided by the figure representing percentage of calcium oxide (CaO), is the basis for comparing costs of different forms of lime.

When well distributed in the soil materials supplying equivalent amounts of calcium oxide will have similar effects. For "pure" materials, 1 ton of quicklime equals 27 cwt. of hydrated lime or 36 cwt. of carbonate of lime.

The waste limes sometimes contain a large proportion of water. They may occasionally contain small amounts of material deleterious to plants, and untried materials should therefore be applied in winter well before sowing the next crop. Waste materials, such as sugar-beet lime sludge, may contain small quantities of other fertilizing substances, such as nitrogen.

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Basic Slag. Basic slag is particularly valuable for the improvement of poor, neglected, heavy land pasture, but it is also useful on grass land of ordinary quality and on other classes of soil. Much grass land suffers from a shortage of available phosphoric acid, and this is remedied by slagging. The basic slag increases the amounts of clover and fine grasses, and improves the feeding nature and palatability of the herbage. In conjunction with better grazing it builds up the fertility of the soil.

How to Buy Slag. Basic slag owes its fertilizer value to the fact that it contains phosphoric acid (P_2O_5) in a form available to plants. As it is a by-product from steel-making its content of phosphoric acid may vary rather widely (from 18 to 8 per cent.). Farmers may not always be able to obtain exactly the grade ordered, but the prices of different slags generally follow the phosphoric acid contents fairly closely. Different slags may be compared in terms of the unit price of phosphoric acid, which is the delivered cost of the slag per ton divided by the percentage of phosphoric acid. Thus slag containing 14 per cent. phosphoric acid and offered at £2 5s. 6d. per ton costs 3s. 3d. per unit. A slag having a low phosphoric acid content should of course be applied at a higher rate per acre.

Basic slags are ground very finely, and the seller must declare the percentage of the material (usually 80 per cent.) that will pass through a prescribed sieve.

In order to distinguish between two main classes of basic slag, use is generally made of the citric acid test, which is described as an optional test in the Regulations of the Fertilizers and Feeding Stuffs Act. For most slags, over 80 per cent. of the phosphoric acid is soluble by this test, but in some so-called "low-soluble slags" the citric acid solubility may fall to 40 per cent. or less. These "low-soluble slags" are generally sold at lower unit-prices in the districts where they are produced. Their phosphoric acid is less available to plants than that in the "high-soluble slags," and it is, therefore, advisable for farmers to ask for the guarantee of high solubility by the citric acid test, unless they have satisfied themselves that the "low-soluble slags" are sufficiently effective for their land.

For "high-soluble slags" with more than 80 per cent. of their phosphoric acid soluble in citric acid, the fertilizer value depends only on the total amount of phosphoric acid present and not on the particular steel making process (Bessemer or Open Hearth) by which they were produced.

The foregoing article is the substance of a manifesto published recently by the Ministry. Copies of this manifesto may be obtained free of charge on application to The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

THE LAND FERTILITY SCHEME

The Land Fertility Committee have not allowed the grass to grow under their feet. Formed on August 3, with Lord Cranworth as Chairman, to administer the Land Fertility Scheme made under the Agriculture Act, 1937, which became law on July 30, they set up the necessary machinery of approved suppliers—producers and distributors of lime and basic slag—in time for operations to start on September 6.

The preparatory work involved the approval of some 300 producers and 2,500 distributors of lime and basic slag in the United Kingdom, as well as bringing to the notice of more than half a million occupiers of agricultural land the conditions that must be satisfied before contributions will be made.

Any occupier of agricultural land* in the United Kingdom may now apply for an exchequer contribution towards the cost incurred by him in acquiring and transporting any quantity, not being less than two tons, of lime and basic slag for the purpose of adding it to the land in order to improve the fertility of the soil. The cost of spreading it on the land after delivery will be borne entirely by the occupier himself.

The contribution will not exceed one-half of the expenditure so incurred in respect of lime or one-quarter in respect of basic slag. Only lime or basic slag produced within the United Kingdom is eligible for contribution.

A farmer who is thinking of using the Scheme may be doubtful whether particular fields require lime or basic slag, or may be uncertain as to the most suitable kinds or grades to buy or the proper quantities to use. These are matters on which he can obtain advice free of charge from the County Agricultural Organizer.

Having made up his mind on these points, his next step is to order his requirements from an "approved supplier." In

* The expression "agricultural land" means, in this connexion, any land used as arable, meadow, or pasture ground, or for the purpose of poultry farming, market gardens, nursery grounds, orchards, or allotments, including allotment gardens within the meaning of the Allotments Act, 1922, or the Allotments (Scotland) Act, 1922. The word farmer used throughout this article includes any occupier of agricultural land so defined.

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view of the large number of distributors who have been approved, it is more than likely that the agricultural merchant with whom a farmer is accustomed to deal will be on the list, but this is a matter on which it is not safe to take risks, since lime or basic slag purchased from anyone who is not an "approved supplier" will not be eligible for contribution. Copies of the list of "approved suppliers" are available for consultation at County Council offices, including those used for Agricultural Education, branch offices of the National Farmers' Union and district offices of associations of agricultural merchants.

Freedom of choice of "approved suppliers" rests with the farmer, but if the selection results in a charge for transport that appears to the Land Fertility Committee to be unnecessarily high, the Committee may, after warning, disallow a sum in excess of the amount which they consider to be reasonable for transport charges in calculating contributions in respect of subsequent purchases by the farmer in question from the same source.

Having satisfied himself that the supplier with whom he intends to place his order is an "approved supplier," the farmer must obtain from such supplier an assurance that the price proposed to be charged for the particular kind and quality of lime or basic slag is permitted by the conditions subject to which that supplier has been approved.

The question of price is all-important, not only because one-half of the cost of lime and three-quarters of the cost of basic slag will come out of the farmer's pocket, but because the action which the Land Fertility Committee have taken to safeguard the farmer against a general rise in prices can only be effective if it is supported whole-heartedly by farmers themselves. As Mr. Morrison stated when introducing the Agriculture Bill in the House of Commons, the problem is how to prevent the increased demand which the Scheme will stimulate from manifesting itself in an increased price; or, in other words, to see that the money voted by Parliament for this purpose does actually reach the pockets of the farmers. The conditions obtaining in the lime industry make this a peculiarly difficult problem. Lime sold for agricultural purposes forms only a part, and by no means the larger part, of the total output of the industry. Amongst the three hundred or more producers of lime for agricultural purposes in the United Kingdom, there will be found, naturally enough, a great diversity in the matter of size and efficiency, which is

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reflected in a diversity of prices. There is little or no standardization of trade descriptions. The Land Fertility Committee have to take the industry as they find it, and, fortunately for the farmers, they find it reasonably competitive, with the additional safeguard that there are, up and down the country, many potential local sources of supply that may come into production if demand tends to outrun supply.

Unlike lime, basic slag is not a primary product, but a by-product of steel making, and its production is in relatively few hands.

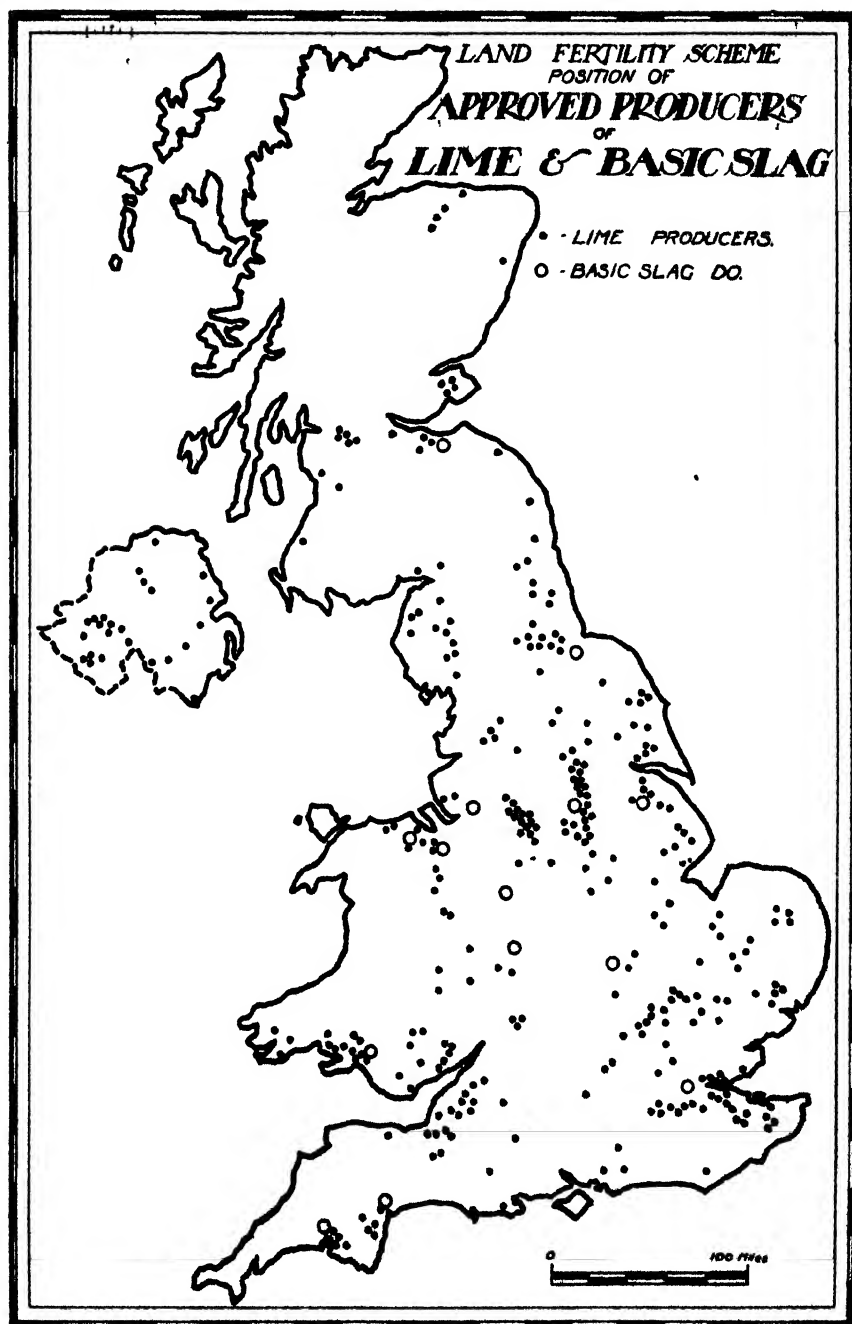
The map on the opposite page shows the situation of the quarries or works of the producers of lime and basic slag who have been approved under the Scheme.

The fundamental condition on which producers have been approved is that the prices they will charge under the Scheme will not exceed those they were charging to farmers on a cash basis for lime or basic slag before the proposals that have been embodied in the Scheme were announced. May 1, 1937, has been taken as the criterion for this purpose. The producers of basic slag have agreed to reduce their May 1 prices by 6*d.* a ton for low-grade slags, 9*d.* a ton for intermediate grades, and 1*s.* a ton for high grades. These reductions will be in force until May 31, 1938, before which date the question of price will be reconsidered.

The suppliers who have been approved are so distributed over the country that it is improbable that many farms are out of range of the distributive machinery that has been set up. The "May 1" principle applies to distributors' margins in the same way as it applies to producers' prices.

Farmers may order supplies under the Scheme by the ordinary methods employed by them for obtaining their agricultural requirements generally. No special order form need be used. Each approved distributor has been supplied with forms, one of which he must send to the farmer on the completion of delivery of each order. The form serves the dual purpose of a delivery note and an application for contribution. The farmer should complete and return to the supplier forthwith the part of the form that requires his acknowledgment of receipt of the lime or basic slag and a declaration that it has been spread by him on agricultural land in his occupation, or will be so spread within six months from the date of delivery. The supplier should then complete the form by filling in the particulars asked for in respect of his distributive margin, and

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send the form to the Land Fertility Committee. The smooth working of the Scheme will largely depend upon farmers and suppliers dealing with these forms expeditiously.

In order to prevent unnecessarily small sums being handed out to a great number of applicants, two tons has been fixed as the lowest unit on which contribution will be made, but special provision is made in the Scheme to enable associations of farmers, allotment holders, small holders or similar associations, which purchase lime or basic slag in bulk for redistribution to their members, to be treated as if they were occupiers of agricultural land. All that is required is that such an association should have written rules governing its constitution and management and should have been certified in writing by the Land Fertility Committee to be an " Approved Association " for the purpose of the Scheme.

Special provision has also been made to cover an occupier of agricultural land who wishes to apply for a contribution in respect of forms of lime (e.g. , chalk, marl for liming, calcareous sea sand, shellsand, waste lime) which he has not purchased but intends himself to produce, render suitable for use or bring upon land in his occupation. In these instances, the occupier is required to furnish the Land Fertility Committee on a prescribed form with particulars of what he proposes to do, and with a detailed estimate of the cost of labour, transport and other incidental expenditure involved. Such estimate, if approved, with or without modification, will form the basis on which contribution will be calculated.

The most economical means of transport must be employed and the Committee may disallow for the purpose of calculating the amount of contribution any charges for distribution or transport which they consider to be excessive. Only amounts actually paid for transport by a farmer or supplier may be included in an application, except when a farmer or supplier uses his own transport to convey lime or basic slag under the scheme, in which event he must include only such amounts as would be charged for the service by a commercial carrier operating under competitive conditions.

The Railway Companies have agreed to allow certain reductions from standard rates in respect of various categories of traffic carried under the Scheme.

THE NEW OATS AND BARLEY SUBSIDY SCHEME

Under Part II of the Agriculture Act, 1937, the appropriate Minister (in England and Wales the appropriate Minister is the Minister of Agriculture and Fisheries) is empowered, in respect of the five years 1937 to 1941, to make subsidy payments to growers of oats and barley in any cereal year when the average price of oats during the seven months September to March is 7s. 7d. per cwt. or less. The average price per cwt. is to be the average price of home-grown oats in the whole of the United Kingdom.

Rate of Subsidy Payments. The Act provides that subsidy payments shall be at a rate per acre equal to six times the difference between the average price per cwt. ascertained for the United Kingdom and a standard price of 8s. per cwt., with a maximum of £1 per acre. The rate of subsidy for land under barley will be the same as that for land under oats, and will thus be determined by the United Kingdom price of oats. Subsidy will not be payable on any area of oats or of barley of less than one acre, and fractions of acres are to be disregarded in calculating any subsidies payable.

Persons to whom Subsidy Payments may be made. The person to whom subsidy payments may be made is normally the occupier of the farm on June 4, but if there has been a change in occupancy before June 4, and the outgoing occupier is entitled to harvest all or part of the crops of wheat, barley or oats on the farm, the Minister may give directions regarding the person who shall be authorized to make the application, and regarding the person to whom the whole or part of any subsidy shall be payable.

Subsidy Payments and Wheat Deficiency Payments. The Act provides that a farmer choosing to receive any subsidy payments payable in respect of land under oats or barley, shall not receive wheat deficiency payments for wheat grown on the same farm in the same cereal year. Each farmer must, therefore, decide each year, and in respect of each of his farms that is farmed as a separate unit, whether he will receive either subsidy payments in respect of oats and barley or wheat

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deficiency payments under the Wheat Act. Payments cannot be made in respect of oats and barley, and of wheat, grown on the same farm in any one year. It is also provided that if there has been any change of occupancy before June 4 which leaves the outgoing occupier with the right to harvest part or all of the grain crops, the Minister may give directions as to the person who shall make the choice.

Standard Acreage. The Act makes provision for the fixing of a "standard acreage" for each of the two crops. This "standard acreage" will be eleven-tenths of the acreage of oats and barley qualifying for subsidy payments in 1937. If in any future year, while the scheme is in operation, the acreage of barley or oats qualifying for subsidy payments exceeds the "standard acreage" the rate of subsidy payment per acre will be reduced in proportion.

Mixed Crops. Land under mixed crops containing oats or barley may be treated as land under oats or barley, but for the purpose of the subsidy the equivalent oats or barley acreage of such crops will be reckoned by calculating the proportion that the quantity of oats or barley sown bears to the total seeds sown on the land in question. Mixed crops of barley and oats will be treated as if part of the land was under oats alone and part under barley alone.

The Barley and Oats Subsidy Payments Regulations, 1937. Regulations have been made jointly by the Ministers concerned with agriculture in the three countries setting out the form in which applications for the oats and barley subsidy shall be made by farmers, and indicating the latest dates on which applications for such subsidy payments will be received by the appropriate Minister. The regulations provide that applications shall be made not later than September 30 in the year 1937, and not later than June 25 in each of the subsequent years during which the scheme is in operation, except in Northern Ireland, where the closing date in future years is June 30.

The regulations also require that every person who has applied for subsidy payment shall, within 14 days after service upon him, by the appropriate Minister, of a notice requiring him to do so, make a declaration that the barley or oats grown

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on the land in respect of which his application for subsidy payment has been accepted, was harvested as grain or, owing to climatic conditions, was not cut until after the day specified in the notice.

Copies of these regulations (price 2d.) may be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller.

Arrangements made for the Distribution of Application Forms to Farmers. Forms of application as prescribed by the above-mentioned regulations together with an explanatory memorandum on the scheme were despatched on September 2 to all farmers in England and Wales whose annual return on June 4 showed an acreage of land under barley or oats or mixed corn. Instructions in the filling in of the application form were printed to form part of the explanatory memorandum.

AGRICULTURAL STATISTICS: THE VALUE OF THE SEPTEMBER INQUIRY

It is over 70 years since the first statistics of acreage of crops and numbers of farm livestock were collected on a national basis in this country. During that time the form of the annual return has not changed to any material extent, and although the number of items on the schedule has tended to increase, the return has remained in most respects very much the same as in the earliest years. The most important event connected with the annual statistics has been the Agricultural Returns Act of 1925. Until then the returns had been collected by agents of the Department, who were unable to bring pressure, other than the pressure of persuasion, to bear upon occupiers of agricultural land who for any reason failed to supply the particulars requested. Missing returns were completed by the collectors, either by personal inquiry among the occupiers and their neighbours, or, in a minority of instances, by estimating from the figures of earlier years. With the passing of the Act of 1925, the position was regularized, and it became a statutory duty of every occupier of agricultural land exceeding one acre in extent, to make an annual return on the prescribed form on such date in the year as the Minister may determine. Almost throughout the 70 years (there was some slight irregularity in the beginning) the returns have related to the position on June 4 in each year.

Official estimates of production of the more important crops date back over 50 years, and, throughout that period, estimates, as reliable as circumstances permitted, of the average yield of the major crops, and the estimated total production of these crops, have been prepared regularly by the responsible Departments. As regards animal products, fruit and the less important crops, the Census of Production Act of 1906 gave the Board of Trade powers to require on a statutory basis statistics of production of manufactured products, and although similar powers were not taken by the Agricultural Departments, particulars have been collected on a voluntary basis regarding yields of milk, eggs and fruit, births and natural deaths of livestock, and carcass weights of animals slaughtered, in the same years as the Board of Trade have carried out censuses

AGRICULTURAL STATISTICS: SEPTEMBER INQUIRY

of industrial production. Commencing in 1935, instead of quinquennial special inquiries, the necessary information is being collected on a five-yearly programme, approximately one-fifth of the additional statistics being obtained each year. The new procedure is not only more convenient for the farmer, but it also enables the results of the inquiries to be published more expeditiously. The particulars so collected have enabled the Departments to estimate, with reasonable precision, the production of meat, milk and milk products, and eggs, and of fruit and other crops, in the Census years; and by applying the average yields to the ascertained numbers of livestock or acreage of crops each year, rough estimates of annual production have been made possible in intervening years.

Farmers as a class have proved to be willing collaborators with the Agricultural Departments in the task of computing agricultural production, and have readily furnished such information as they have, or such estimates as they could make, when asked to do so. To most men, among whom farmers are not exceptional, the filling in of forms is an uncongenial task. Most of the voluntary inquiries carried out by the Ministry in connexion with the Censuses of Agricultural Production have brought in replies from well over one-half the farmers of the country, and bearing in mind the frequently somewhat recondite character of the questions asked, this proportion can be regarded as surprisingly high.

The increasing importance of statistical information in relation to the development of government agricultural policy in recent years, has led the Ministry to ask for yet further statistical information from farmers. In 1933, and again in 1935 and 1936, a voluntary return of the numbers of cattle, sheep and pigs on farms on December 4, gave authoritative figures of the livestock population at a point midway between the returns of the preceding and subsequent June. Here again the response of farmers was very satisfactory, the proportion of completed returns amounting to 73 per cent. in 1933, 85 per cent. in 1935 and 71 per cent. in 1936. The estimates of total numbers of stock, based on so large a sample, can be accepted as accurate within a very small margin.

The collection of particulars of cattle and sheep at intervals of six months is perhaps adequate to enable reasonably accurate forecasts of home supplies of beef and mutton to be computed, and the information obtained through the medium of these special inquiries, in conjunction with the June returns,

AGRICULTURAL STATISTICS: SEPTEMBER INQUIRY

has been of the greatest value to the Government in connexion with the regulation of imports. The pig population, however, can change very rapidly, and in the absence of other statistics it is impossible to forecast with safety future supplies of pigs for slaughter upon data collected at such lengthy intervals. While the contract system for bacon pigs was in force, the future course of home bacon supplies was known with fair accuracy, and the regulation of imports of bacon to maintain the national supply at the Lane-Fox level, was hardly more than an arithmetical problem. With the breakdown of the contract system, it became a much more difficult task to forecast supplies. Figures of the pig population are needed at more frequent intervals, and the Ministry, together with the other Agricultural Departments, has arranged that, for the time being, statistics of pigs on agricultural holdings shall be obtained from farmers on a voluntary basis every three months. The first form of return for this purpose was sent out to all farmers at the beginning of September.

The form of return for pigs provided also spaces in which farmers were asked to state the numbers of turkeys and the numbers of agricultural tractors upon their holdings on September 4. The question may well be asked what relation there is between pigs, turkeys and agricultural tractors. The answer is that there is none: it merely happens that the Ministry is anxious, for a number of reasons, to obtain information regarding these items, and has taken the opportunity afforded by the first quarterly pig census to collect information also about turkeys and tractors.

It is a matter of common knowledge among poultry keepers that the hatching season for turkeys has tended in the last two years to extend beyond the early part of June into July, the reason no doubt being the endeavour of farmers to produce light-weight turkeys for the Christmas trade, under the shelter of the import duty of 3d. per lb. on foreign birds imposed in May, 1935. Hitherto, however, there has been no satisfactory measure of the importance of this development and no means of estimating with reasonable accuracy the supplies of home-bred turkeys likely to be marketed for the Christmas trade. The particulars collected in September, when the hatching season is over, will, it is hoped, afford a reliable guide not only to the absolute supplies of turkeys to be marketed this year, but also to the increase that these supplies represent over those of earlier years, when the hatching

AGRICULTURAL STATISTICS: SEPTEMBER INQUIRY

season was virtually over by the time the June returns were collected.

As regards agricultural tractors, it has been the Ministry's practice to obtain, at the time of the Census of Production, voluntary particulars of the number of the various kinds of agricultural machinery on farms. The decline in the numbers of farm workers makes the question of the increasing use of machinery of the greatest importance. It is well-known that the use of tractors on farms has been greatly stimulated in recent years, but precise information regarding the extent of this development has been lacking. The information collected this year should serve to remedy this deficiency, and should also enable the Government to judge the rate at which the tractor is replacing horse and human labour.

It is already evident that this, the latest of the Ministry's applications for voluntary information from farmers, will meet with a response as gratifying as when similar inquiries have been made in the past. About 370,000 forms of inquiry were sent out on September 2, and by the end of the following week no fewer than 170,000 had already been returned, while by the 23rd of the month the total of replies had reached 240,000. Farmers, and the Ministry, may look with some satisfaction upon this admirable response to a voluntary questionnaire sent out at a time of year when farmers have little spare time in which to fill in statistical forms.

FARMING & FACTORY MANAGEMENT IN DENMARK

S. L. CORNER, B.Sc.*

In order to complete the qualifications required for a degree in Dairy Science in this country, it is necessary for students to spend a month in a dairy factory. The writer of the article being *in statu pupillari* took the opportunity that was offered to spend that time at the Danish State Experimental Dairy near Hilleröd, on the island of Zealand, some 20 miles north of Copenhagen.

The countryside gives the impression of wide plains studded with neat whitewashed farms and cottages, and low rolling uplands covered with large birch forests.

The soil and climate of this part of Denmark are particularly suited to dairy farming and the intensive system of cropping practised. In Zealand the soil is chiefly boulder clay—rich soil—well managed. The boulders turned up during ploughing are collected and used for building walls, and for roads. They are mostly flints, and granite of both types—the dark acid granite of quartz and black mica and the basic type of quartz, pink orthoclase and white mica.

The beaches fringing the coastline are narrow, there being little or no tide, and the sea deepens quickly, making the harbour at Copenhagen accessible at all times of the day.

Denmark is said to be one of the windiest countries in the world; while the prevailing winds are westerly owing to cyclonic influence, easterly winds from Germany and Russia due to anti-cyclonic conditions are also experienced. Comparing the general weather conditions with those of England, it may be said that they are similar, except that the summers are warmer and the winters colder owing to the influence of the landmasses of Eastern Europe and Asia.

In order to get a general idea of Danish methods of farming, several farms were visited. The farmers themselves were very helpful, and every other person one met seemed to speak a little English. Two farms have been singled out as typical examples of the agriculture as practised here. Both were about

* Miss Corner was awarded a Ministry of Agriculture junior scholarship as a daughter of a farm worker, and later a senior scholarship for a degree course in dairying at Reading University, which she has just completed.

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100 acres—which is quite large—the majority of farms being less than this.

The first selected had no permanent grass and was worked on a seven-course system—summer fallow, wheat, barley, roots, oats and 2-years' seeds. The seeds mixture was Italian rye grass, timothy and red clover. The pastures looked rather rough, as could only be expected from the short ley, but there was plenty of grass for stock feeding well on into September.

The other holding had a small acreage of permanent grass, which is unusual and slightly affected the rotation, which consisted of wheat, potatoes, barley, beet, grass and oats.

The one-year's seeds mixture consisted of 40 per cent. early red clover, 20 per cent. timothy and 40 per cent. trefoil. Skim ploughing was practised to eradicate weeds.

Cows. Both farms had 15-20 cows in milk—giving an average of 350 lb. of butter per lactation—i.e., about 650-700 gallons. of rich milk. On the first farm an attempt was being made to eradicate tuberculosis, the tuberculin test being applied. The unaffected animals were kept in an isolated part of the cowhouse. The cows are all of the Danish-red type—and except on the larger farms where there are fences, it is usual to tether them in the fields. This is claimed to be a much more economical method of grazing—and the land certainly looked well.

Heifer calves are reared to come into the herd. Bull calves are usually sold as veal, except that those from the best cows, if got by a good bull, are kept for breeding.

Feeding is similar to that practised in England—hay, roots, and kohl rabi, with a cake mixture, being used in winter, and grass and cake in summer. The A.I.V. type of silage is made, although this is not usual on the smaller farms. The food-stuffs are home-grown whenever possible. Second-class grain is used for feeding.

Milking is all done by hand—chiefly by women. At Faurholm, during the summer the 50 to 60 cows are managed on a system similar to the Hosier plan, the cows being collected into a corral, and then milked and fed in a shed. The milk is sieved into churns, and cooled later by means of a carbon dioxide cooling plant at the farmstead. Weighing and recording are carried out twice a week.

Horses, Sheep and Poultry. In this district the *horses* were of the local Fredensborg type, which it is thought were

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originally imported from Belgium. Farmers usually breed their own horses—a farm of 100 acres maintains 5-6 horses. Nursing mares work during the day with the foal running alongside. A pretty sight are these foals, so friendly, and unafraid, which speaks well for their general treatment and management.

The *poultry* are chiefly White and Brown Leghorns, Plymouth Rocks, Light Sussex for table purposes, in addition to turkeys, ducks and geese. Poultry are maintained on free range on the smaller farms, but generally in pens of 20-50 birds on the larger farms. Large numbers of the eggs obtained are sent to England.

Sheep in Denmark are an uneconomical proposition in view of the intensive nature of the farming, and consequently there are very few to be seen, except on the less fertile parts of the peninsula of Jutland.

Pigs. The pigs generally kept are the well-known "Landrace," and a cross between the Large White Yorkshire and a Danish variety. On the farms mentioned a few sows were kept, the litters being fattened for the bacon factory. To control bacon production farmers are only allowed by the Government to keep a limited number of pigs, such numbers being related to the size of the farm. Each farmer has an official "ticket" stating the number allowed. Farmers can, however, keep more than their allocation by buying "ticket rights" from farmers who do not wish to take up their full "quotas." Thus the level of production is maintained and individual farmers can regulate their own particular requirements.

The average number of pigs reared per litter is stated to be 8 or 9. The sows are kept indoors, whilst the little pigs are more or less on "free range" up to 8 weeks old.

The sour skim milk returned from the local manufacturing depot is used for feeding together with a simple meal mixture—usually ground at home and consisting of 20 per cent. wheat meal, 60 per cent. barley meal, and 20 per cent. crushed oats.

Pigs on the State Farm—Faurholm. At Faurholm are carried out experiments in feeding, housing, etc., an adjacent farm being used as a control for these experiments.

The pig houses have a brick base up to about 4 ft. 6 in. which is the window level. Above this the whole is made of wood. A loft is always made for storing bedding, etc., and

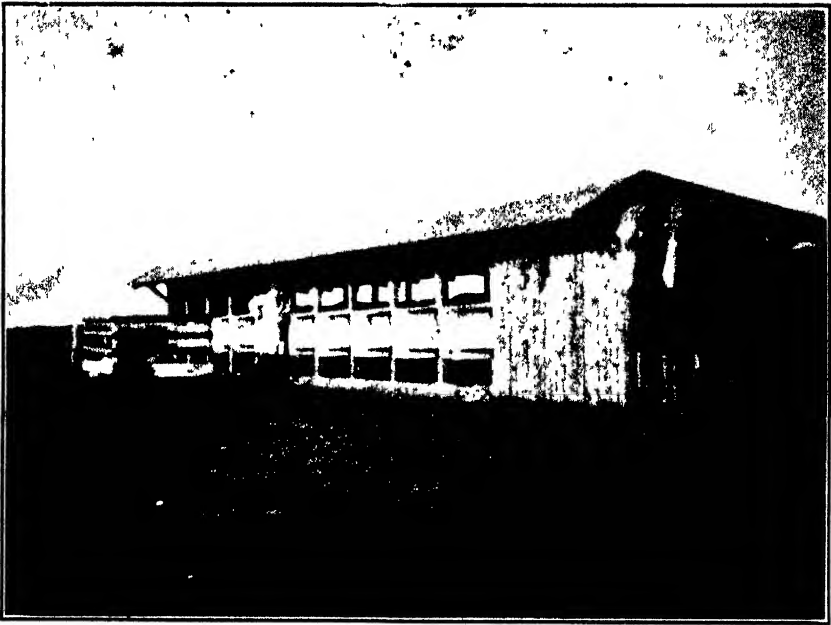


FIG 1.—The Outdoor Milking Shed at Faurholm



FIG 2 Interior of the Pig House at Faurholm

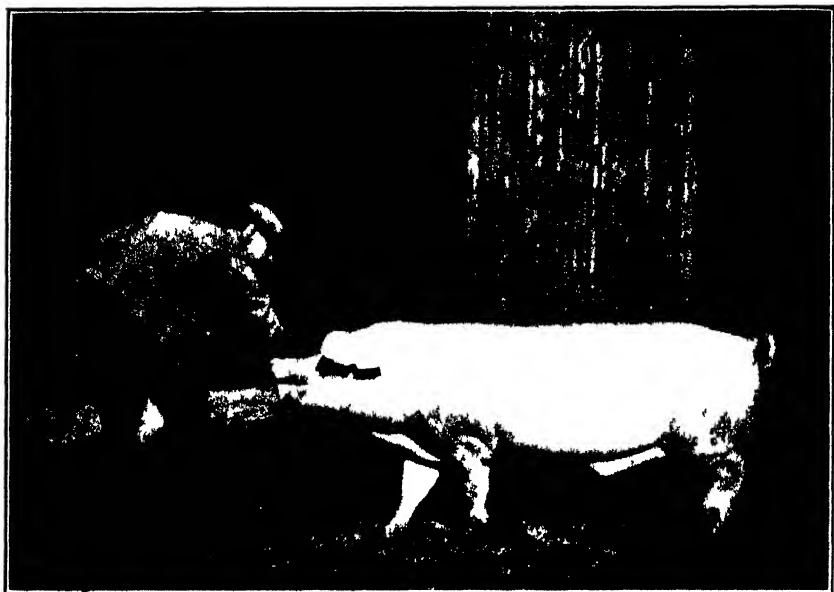


FIG 3 A Young Prize Landrace Boar

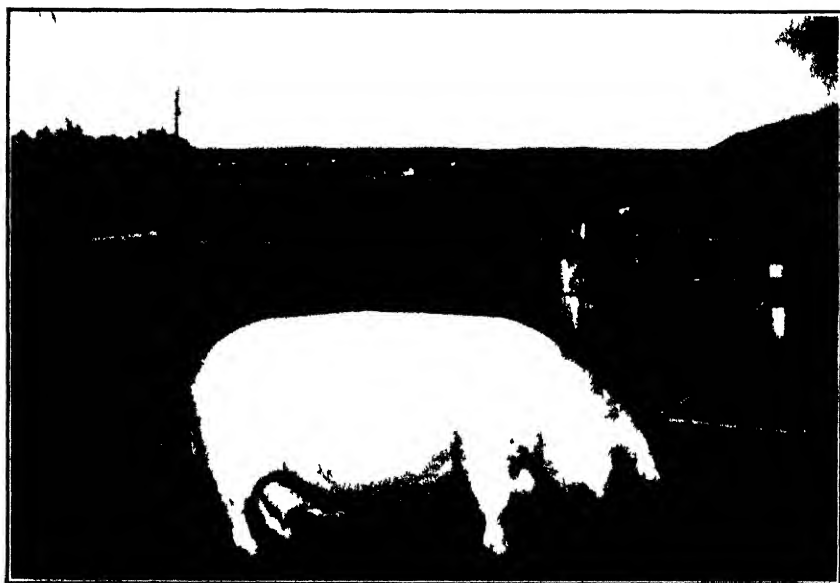


FIG 4 A Landrace Sow of Good Type.

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to assist in providing warmth in winter and coolness in summer. The interior is whitewashed twice a year, and the pens whenever they are empty. The floors are of concrete. A wooden straw-covered bed is used. The size of the pens varies from 10 ft. x 8 ft. to 10 ft. x 10 ft., according to the use and number of pigs. Indoor farrowing pens are 10 ft. x 8 ft. There is a feeding passage down the centre of the building, and dunging passages on each side.

The sow breeding pens lie on the southern sheltered slope of a hill near the farmstead. Separate wooden huts are provided for each sow, with a good sized pen attached. The sows are weighed once a fortnight and fed according to weight. Sows and litters run outside until the little pigs are weaned at 8 weeks old. Young boars are castrated whilst still with the sow. There is no store period—the little pigs being fattened steadily from weaning for bacon.

The amount of food given to baconers depends on their weight. It consists either of sour skim milk, or skim milk, or skim and whey together with a meal mixture of wheat, oats, and barley in the proportions previously mentioned. Sometimes a little maize meal is added to the ration. Fish meal is not used, since the skim milk provides the necessary protein.

At Faurholm experimental work covers a wide range. Of the more unusual experiments that are worth recording are those on the control of flies, the effect of sunshine on sows and their litters, and the feeding of thyroid glands to fattening pigs.

Flies similar to the common housefly persist in large numbers in Denmark and are a fruitful source of contamination. They are thought to breed most quickly in pig manure. As a result of experiments a routine method of control has been elaborated, in which the manure is covered with sacking for about three weeks. By the end of this time the fermentation set up has killed all the grubs and experience shows that the manure does not become reinfected.

The object of the sunshine trials was to ascertain its effect on the percentage of haemoglobin in the blood. Sows were kept indoors and given no green food. Half the litter was allowed to run outside while the other half was kept indoors under shaded conditions. Fortnightly tests were made. Those allowed out of doors showed a consistently high haemoglobin content, while those kept inside decreased to 20 per cent. or 30 per cent. and either died or became anaemic.

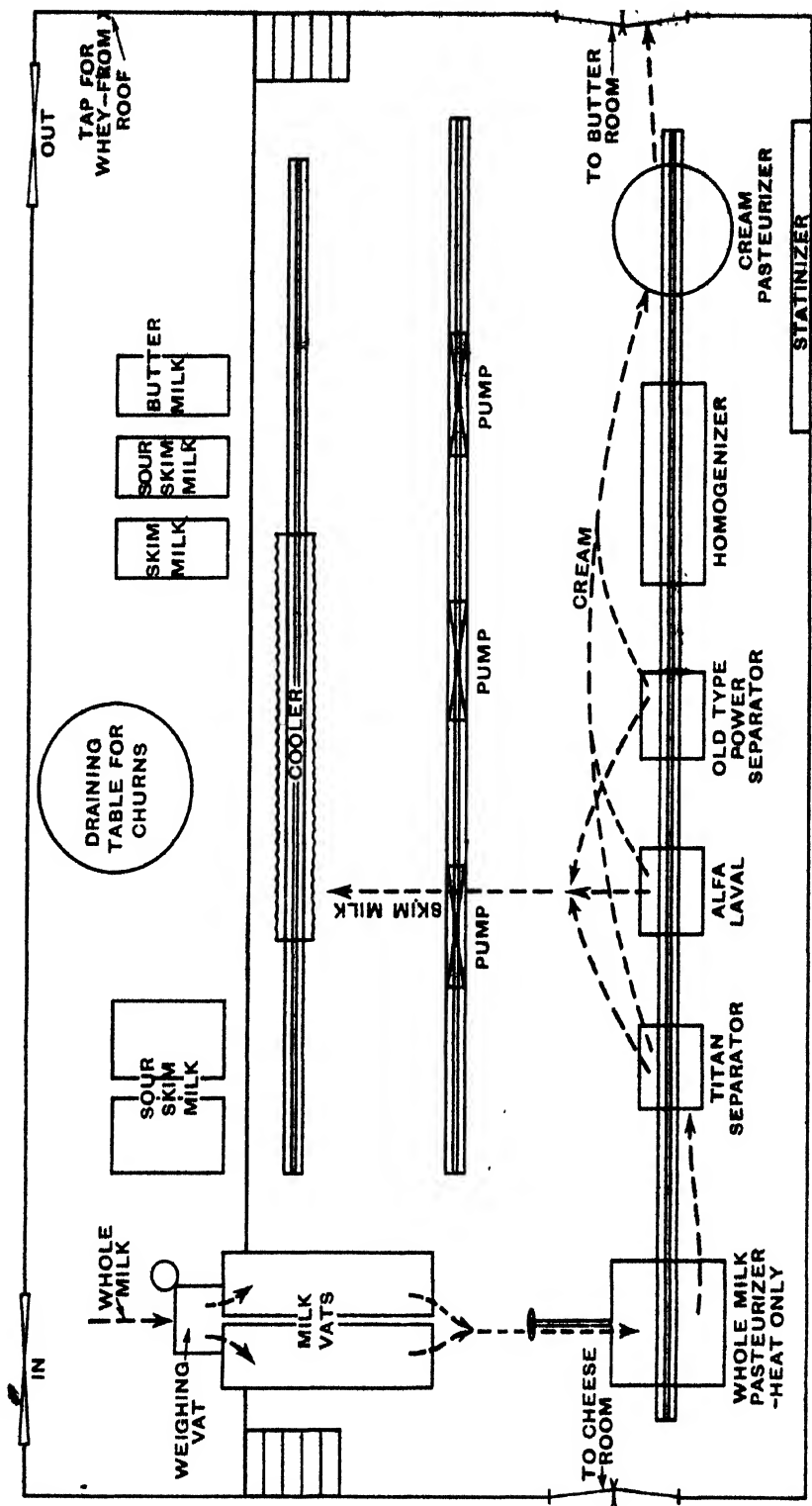


FIG. 5.—Danish State Experimental Dairy at Faurholm. Lay-out of the Dairy Room.

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Weekly feeding with cut-up thyroid glands was the routine of another experiment designed to test the theory that by the use of thyroid the percentage of fat in carcasses can be reduced. Results, however, were not available.

The State Experimental Dairy. The dairy is a commodious E-shaped building made of red brick, with interior walls faced with glazed tiles where desirable. The rough layout, Fig. 5, shows the general disposition of departments.

The milk, which comes in from surrounding farms, is in churns of approximately 10 gallons each; about 2,230 gallons are received each morning. The churns are numbered serially and are unloaded into the skim hall. The number is checked on a record sheet, and the milk is tipped into the weighing vat and the weight of the milk recorded. The empty churns are then placed on a circular revolving table to drain, after which they are taken off, and filled with skim milk, whey or butter milk, since each farmer is allowed to take back 60 per cent. of the amount brought in.

A sample is taken daily; this is bulked, and Gerber-tested for fat percentage once a week—potassium dichromate being added as a preservative. From this test is calculated the butter percentage obtained from the milk and the weight of butter delivered to the dairy. On this weight payment is made to the owner at the current price of butter less a charge at the rate of 2-3 öre* per litre for the skim milk taken home. Any profit made out of the sale of skim milk is paid out to farmers as a bonus once or twice a year.

The methylene blue test for keeping quality is also carried out, and 3rd and 4th grade milks are penalized $\frac{1}{2}$ and $\frac{1}{4}$ ore respectively per litre. After weighing, the milk passes through a muslin strainer and is pumped into a pasteurizer of the A.P.V. type—the hot milk being partially cooled by the cold milk entering. After being heated in the pasteurizer by hot water to a temperature of 180° F. for one or two minutes the milk passes to a small holding cylinder for 1 minute to ensure the heating of all the milk and then back to be partially cooled for separating.

The separators are of the large-power, non-foaming types, Alfa-Laval, and Titan. The cream is taken off with 30 per cent. fat—it is then re-pasteurized in an upright pasteurizer that both heats and cools it to ripening temperature, after which

* 100 öre are approximately = 15.

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it is passed into large circular tanks for ripening in the butter room.

The skim milk is run over a large cooler and from there pumped along an overhead pipe line to the cheese room. The surplus skim milk not required for cheese passes into two large vats, where 1 per cent. starter is added. After it has ripened farmers have the advantage of taking back this properly cultured milk on the following day for pig feeding.

Skim milk only is used for making the starter, which contains the usual lactic acid streptococci. New starter culture is used once a fortnight, being bought in the liquid form.

The machinery is fastened in position on to double sets of rails let into the floor. The reason for this is that since the dairy is essentially an experimental centre, it is necessary to make the machinery easily movable for purposes of replacement or rearrangement. During August and September, 1936, the power was provided by electric motors, but on October 1 an experiment was started to find the most economical form of power. Electric, steam, and Diesel oil engines were to be alternated, each running for a week, throughout the year and running costs carefully calculated and compared.

On entering the buttermaking room one is struck by the spaciousness and cleanliness of it, and by the purity of the atmosphere. The air entering this room is filtered, and may almost be said to be sterile. This lessens the chance of contamination with the wrong type of bacteria during ripening and churning.

The large circular ripening tanks hold 900-1,000 litres (approximately 200-250 gal.) of cream, and are fixed to a pedestal that can be raised or lowered by means of a pump. As the cream enters these vats about 1 per cent. of starter is added, and this gives an acidity of 90 cc. N/10 NaOH per 100 cc. cream in 24 hours. The temperature of the cream for churning goes down to 13° C., and during very hot weather ice is added just before churning.

The churns are of the large Silkeborg wooden type, with a churning capacity of 250 gallons, with wooden rollers inside for working.

No breaking water is added, since this greatly lengthens the time taken in churning. The butter is washed twice, then worked by the rollers until the water content is just under 16 per cent. It is dry salted to the extent of 1 per cent.

The butter is finally packed into 1-cwt. tubs or made into

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pounds avoirdupois by machine and wrapped, after which it is packed into boxes.

When large quantities of milk and cream are being dealt with daily it is of the first importance that the losses of butterfat should be reduced to a minimum, and every care taken to ensure that the conditions adopted are conducive to obtaining the highest yields. Much experimental work is in progress to ascertain the relationship between the fat content of the cream and losses of butterfat in the resulting buttermilk under various conditions, and also the effect of temperature during pasteurization on butter qualities and the rate of butter formation.

The equipment for cheesemaking consists of two large vats of 450-650 gallons each, with an automatic stirring device moveable from one vat to the other. In these two, Danish-Swiss cheese was made. Edam was also made in a circular Dutch vat fitted with automatic cutting and stirring knives.

In order to get the correct fat percentage in the finished cheese all the milk is separated, cream being added to the requisite amount. For Danish-Swiss the percentage of fat required in the milk is approximately 2.8-2.9 per cent., and for Edam 2.5 per cent.

The amount of starter varies from 0.5 to 0.75 per cent. in Edam and Danish-Swiss respectively. Calcium chloride is put in to counteract the deposition of the soluble calcium salts due to pasteurization. Saltpetre is also added, as well as a little common salt, with the object of reducing the trouble due to gas formation by coliforms. This it does presumably by acting as a hydrogen acceptor, so that the hydrogen evolved by the coliforms is thus absorbed.

Both the above types of cheese are very sweet during the process of making; acidity develops very slowly, and when put to press the curd is still quite sweet. At moulding Danish-Swiss gave an acidity of 0.13 per cent.

The method of scalding is not heating by means of a steam jacket, but by removing 10 per cent. of the whey and adding 5 per cent. of boiling water. After pitching and pushing up the curd it is pressed slightly for 20 minutes, cut into blocks and put into moulds, turned once in the mould into cloths, and then put to press. The cheeses are turned once in the press, and remain there 2-3 hours, according to size, after which they go into concentrated brine for 3-4 days. The cheeses are then ripened in rooms at a controlled temperature of 15-18° C. and humidity 95 per cent. Here they remain 3-4 weeks, being turned daily

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and oiled, or washed with brine according to their condition. On leaving these rooms for storage they are dipped in hot wax to seal the coat. Storage rooms have a slightly lower temperature and humidity.

The Danish-Swiss type is ripened 1 month and stored 2-3 months, while the Edam is ripened for 3-4 weeks and stored 1 month.

The whey from the cheesemaking is separated and then pumped into a large tank on the roof of the dairy where it is boiled and used by farmers for feeding pigs as mentioned previously.

A certain amount of whole milk is set aside for liquid consumption. This milk is stassanized and then put into 1 litre or $\frac{1}{2}$ litre cartons (1 litre = $1\frac{1}{4}$ pints) made of a parchment-like substance that shows up the cream line very well.

In conclusion, a rather interesting matter in the development of town milk supplies in Denmark is worth mentioning. Before going to Denmark the writer had occasion to read H. Rider Haggard's book on Rural Denmark, written in 1910. In one chapter a visit to the "Copenhagen Milk Supply Company" is discussed, as well as the methods of handling milk and also the alleged price-cutting carried on by milk supply companies. Haggard suggested that the production of pure milk was a matter to be considered in the interests of public health. At the end of the chapter he states that the matter of municipal trading is a somewhat thorny question and therefore leaves it with the remark that "those who are alive 25 years hence will probably see in every town an institution labelled 'The Corporation Pure Milk Supply Dépôt.'" On making inquiries in 1936 for such a dépôt, it was found that there were two such dairies in the small town where I was staying. On visiting one of them I found that the milk and cream were pasteurized and bottled and capped by machine. Some of the milk went to Copenhagen. In addition large quantities of ice-cream were made to supply shops in the neighbourhood. The system of supplying shops is to provide each shopkeeper with an ice chest and then to supply ice and ice-cream daily. The delivery vans are insulated, and between the compartments for milk, ice-cream, etc., are spaces with a mixture of 5 per cent. brine and ice, so providing the necessary low temperature required during delivery.

REARING YOUNG PIGS.—II*

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It is common knowledge that piglings weaned at the age of 8 weeks are liable to suffer a check after weaning. During the autumn and winter months this post-weaning check frequently has very serious repercussions; between the ages of 8 and 12 weeks the growth rate of a large proportion of the piglings is slow in most litters, whilst the mortality amongst some litters is unduly high. This not only causes loss to breeders, but helps to create a shortage of bacon pigs in the late spring, and to accentuate the early autumn glut, for during the latter period the more rapidly growing spring litters catch up the slower growing late winter litters. The results obtained in an experiment carried out during the year 1936-37 indicate that the post-weaning check is partly due to malnutrition, and that its effects can be obviated or reduced by suitable feeding.

The post-weaning check rarely occurs amongst piglings that receive separated milk in their rations, but this material is not available in many districts, especially during the autumn and winter months. A trial was carried out in 1934 with spray-dried separated milk, but it had to be discontinued because the piglings receiving this material suffered from violent diarrhoea. A second trial was made in 1935, and had to be abandoned for the same reason. Subsequent to the discovery of barley water-iron, recorded in Part I of this article, it was found that piglings that received this material between the ages of 2 and 6 weeks suffered no ill effects when spray-dried separated milk was added to their rations between the ages of 6 and 12 weeks. The evidence obtained indicates that piglings receiving barley water-iron between the ages of 2 and 6 weeks are comparatively free from digestive troubles, and the inference is that *a healthy pig* can take a ration containing

* Part I of this article appeared in the September, 1937, issue of this JOURNAL.

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spray-dried separated milk without suffering any ill effects, whereas if certain forms of digestive troubles are present they are liable to be intensified by its use.

An experiment was started in October, 1936, to ascertain whether the ill effects of the post-weaning check could be avoided by, (a) using barley water-iron between the ages of 2 and 6 weeks and adding spray-dried separated milk to the rations fed between the ages of 6 and 12 weeks, and (b) placing barley water-iron at the disposal of the pigs between the ages of 2 and 12 weeks.

The litters used were selected in pairs, the two litters in each pair being as nearly as possible similar in regard to (i) date of farrowing, (ii) breeding, and (iii) number of pigs alive at 3 weeks old. Eight pairs were obtained during the autumn and winter; one litter from each pair was put into Group III and the other into Group IV. Four winter litters that could be paired only with litters in Groups III and IV were put into Group V. The treatment of the 3 groups was similar in all respects except in the feeding of the sucking pigs.

The sucking pigs of all groups had access to barley water-iron from the time they were 2 weeks old until they were eating an appreciable quantity of soaked meal, at which stage the barley water-iron was discontinued in Groups III and IV. Group V received that material until the pigs were 12 weeks old. The quantity of barley water-iron used in this experiment was 1 pint to each 8 piglings, no additional barley water being given. A fresh supply was put into the pens daily. In the early stages, when the piglings did not drink the whole of their allowance, the unused portion was removed at the end of the day and given to other stock.

When the piglings were 3 weeks old, a low trough containing a little dry meal was placed beside that containing the barley water-iron. Ration No. 4 (Table I) was used for all groups. They were offered soaked meal twice a day as soon as they would eat it, and when they were eating an appreciable quantity of the soaked meal, dry feeding was discontinued. Groups III and V received Ration No. 4 up to the time of weaning, and Ration No. 2 after weaning. From the time they would eat soaked meal, Group IV received the same rations plus spray-dried separated milk—the quantity added being 15 lb. to each 100 lb. mixed meal before weaning, and 10 lb. per 100 lb. mixed meal after weaning. The feeding of the three groups is summarized in Table I.

REARING YOUNG PIGS.—II

TABLE I
FEEDING OF PIGLINGS
(In Parts by Weight)

	<i>Group III</i> (Control)	<i>Group IV</i>	<i>Group V</i>
From age of 2 weeks to time piglings would eat soaked meal	Barley water-iron	Barley water-iron	Barley water-iron
From age of 3 weeks to time piglings would eat soaked meal	Ration No. 4 dry— <i>ad lib.</i>	Ration No. 4 dry— <i>ad lib.</i>	Ration No. 4 dry— <i>ad lib.</i>
From time piglings would eat soaked meal to weaning (8 weeks)	(soaked) Ration No. 4	(soaked) Ration No. 4 plus Spray-dried Separated Milk	(soaked) Ration No. 4 plus Barley water-iron
From weaning (8 weeks) to 12 weeks	Ration No. 2	Ration No. 2 plus Spray-dried Separated Milk	Ration No. 2 plus Barley water-iron

Barley water-iron was given at rate of 1 pint to each 8 pigs. Spray-dried separated milk was added at the rate of: (a) before weaning—15 lb. per 100 lb. mixed meal, (b) after weaning—10 lb. per 100 lb. mixed meal.

RATIONS
(In Parts by Weight)

	<i>No. 4</i>	<i>No. 4</i> <i>plus</i> <i>Spray-dried</i> <i>Separated Milk</i>	<i>No. 2</i>	<i>No. 2</i> <i>plus</i> <i>Spray-dried</i> <i>Separated Milk</i>
Barley meal	35	35	30	30
Flaked maize	15	15	15	15
Weatings	50	50	45	45
Fish meal	—	—	7½	7½
Soya-bean meal	—	—	2½	2½
Spray-dried separated milk	—	15	—	10

1½ lb. chalk and ½ lb. salt added to each 100 lb. mixed meal in all rations.

At the commencement of the experiment the dried milk powder was kept apart from the meal mixtures until required for use, when it was mixed with water and remade into separated milk, which was added to the meal instead of water. Since December it has been found to be equally satisfactory and much simpler to mix the powder in a dry condition with the other constituents when they are mixed together.

The piglings were confined to styes with concrete floors, and, except in the details enumerated above, the feeding and general management were on the same general lines as in the 1935-36 experiment described in Part I of this article.

REARING YOUNG PIGS.—II

Results. The figures given below are for autumn and winter litters.

GROUP IV. Between the ages of 8 and 12 weeks the difference in the growth rate of the comparable litters of Groups III and IV was definitely in favour of Group IV in all 8 pairs. It was sufficiently great to be detected by eye. Fig. 1 shows a litter from Group III and Fig. 2 the comparable Group IV litter. A clearly defined result was also obtained in connexion with the mortality rate. Pigs were lost from 4 of the pairs, and in all these instances the figures definitely favoured the Group IV litter. The litter averages are summarized in Table II.

TABLE II

LITTER AVERAGES OF GROUPS III AND IV (AUTUMN AND WINTER LITTERS)

	<i>Group III</i>	<i>Group IV</i>
<i>Number of litters</i>	8	8
<i>Number of pigs at 3 weeks</i>		
Total	81	76
Average per litter	10.1	9.5
<i>Mortality :</i>		
Before weaning (3-8 weeks)	4	1
After " (8-12 ")	9	2
Total (3-12 ")	13	3
<i>Average weight per pig .</i>		
at 3 weeks	10 0 lb	11.0 lb
at 8	26 0 lb	29 0 lb
at 12 .. *	38 6 lb	49 6 lb

* One of the control litters was reduced to 3 pigs, and the 12-week figures for this litter and the comparative litter of Group IV were omitted from the 12-week averages, which are for 7 litters only in each group.

All the litters in Group III suffered from the post-weaning check; between the ages of 6 and 8 weeks the increase in weight was only 12 lb., and 9 pigs (=11 per cent.) were lost. No noticeable check occurred in the growth of the pigs of Group IV, the average increase in weight of this group being 20 lb., and only two pigs were lost (=2.7 per cent.). The superior growth of the pigs in Group IV must be attributed to the spray-dried separated milk, which was added to their rations between the ages of 6 and 12 weeks, as this was the only difference in the treatment of the two groups.

Spray-dried separated milk is comparatively expensive, but pigs only eat a small amount of meal before the age of 12 weeks. Those in Group IV consumed an average of 57 lb. per head, containing less than 7 lb. of dried separated milk,



FIG. 1 One of the Litters from Group III



Fig. 2 The Comparable Litter from Group IV

REARING YOUNG PIGS.—II

the cost of which was trivial when compared with the benefits that accrued from its use.

GROUP V. The 4 litters in Group V were all superior to the comparable litters, both in regard to growth and death rate. The results are thus worthy of consideration in spite of the small number in the group. Table III gives the average figures for Group V and of the comparable litters.

TABLE III
LITTER AVERAGES OF GROUP V AND COMPARABLE LITTERS

	<i>Controls</i>	<i>Group V</i>
<i>Number of litters</i>	4	4
<i>Number of pigs at 3 weeks</i> ..		
Total	44	42
Average per litter .. .	11	10.5
<i>Mortality :</i>		
Before weaning (3-8 weeks) .. .	5	3
After " (8-12 ") .. .	8	2
Total " (3-12 ") .. .	13	5
<i>Average weight per pig</i>		
at 3 weeks .. .	10.0 lb.	11.0 lb.
at 8 " .. .	26.4 lb.	28.3 lb.
at 12 " .. .	36.0 lb.	42.7 lb.

The relatively poor results obtained from these litters was largely due to the fact that they were born in October, November and early December, which is the worst time in the year for young piglings. The pigs in all the control litters suffered badly from the post-weaning check; between the ages of 8 and 12 weeks the average increase in weight was only 9.6 lb., and eight pigs (=18 per cent.) were lost. The pigs of all the litters in Group V suffered slightly from the check, but the ill effects thereof were definitely less than in the comparable litters; the average increase in weight was 14 lb., and only two pigs (=5 per cent.) were lost. The inference is that in Group V the ill effects of the post-weaning check were reduced by the action of the barley water-iron given to the pigs of that group between the ages of 6 and 12 weeks.

The cost of the barley water-iron used was about 2s. per pig.

Necrotic Enteritis. Post-mortem examinations made by the Veterinary Department revealed the fact that all the pigs that died in Group III between the ages of 8 and 12 weeks were suffering from necrotic enteritis. The 2 pigs lost from Group V were also suffering from this complaint. One of the 2 lost from Group IV had the lesions of necrotic enteritis, and the other showed the symptoms of acute anaemia. The inference to

REARING YOUNG PIGS.—II

be drawn from the distribution of the cases of necrotic enteritis is that this disorder is associated with malnutrition.

Summary. Observations made in carrying out these experiments indicate that:

I. Whilst a healthy pigling can derive benefit from a ration containing spray-dried separated milk, the use of such rations is liable to intensify certain forms of digestive trouble if they are present.

II. Necrotic enteritis is associated with malnutrition.

III. The growth of a pigling weaned at 8 weeks old is liable to suffer two checks, the first occurring between the ages of 2 and 5 weeks, and the second between the ages of 8 and 12 weeks. The ill effects of these checks are most noticeable during the autumn and winter months, when they are liable to have serious repercussions. In *most litters* the rate of growth is reduced, whilst in *some* a heavy mortality occurs.

The results obtained in the experiment discussed in Part I show that the first check can be avoided by placing barley water-iron at the disposal of the piglings from the time they are 2 weeks old until they are eating an appreciable quantity of supplementary food, which the piglings in the treated group did when they were about 6 weeks old.

The results obtained in the experiment discussed in Part II indicate that, *with piglings that receive barley water-iron between the ages of 2 and 6 weeks* the ill effects of the post-weaning check can be, (a) avoided by the use of rations containing spray-dried separated milk between the ages of 6 and 12 weeks, or (b) greatly reduced by placing barley water-iron at the disposal of the piglings between the ages of 6 and 12 weeks.

These methods were observed to give the best results with litters nursed by heavy milking sows and should be regarded as a supplement to careful selection of breeding stock and efficient feeding of the pregnant and nursing sow, which are the foundations of successful rearing. They are liable to fail with the litters of indifferent or ill-fed sows, especially if the piglings are badly nourished before the age of two weeks.

The writer desires to express his thanks to the Veterinary Department for help received in connexion with this work. The Staff of the Department have made all the post-mortem examinations and assisted on numerous occasions with helpful advice.

CROP HUSBANDRY IN THE 18TH CENTURY: LINCOLN AND RUTLAND

G. E. FUSSELL

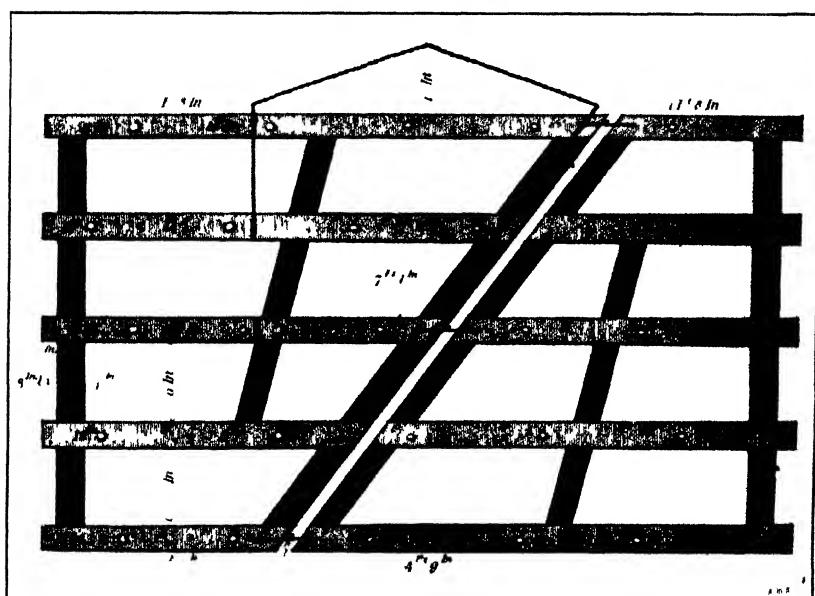
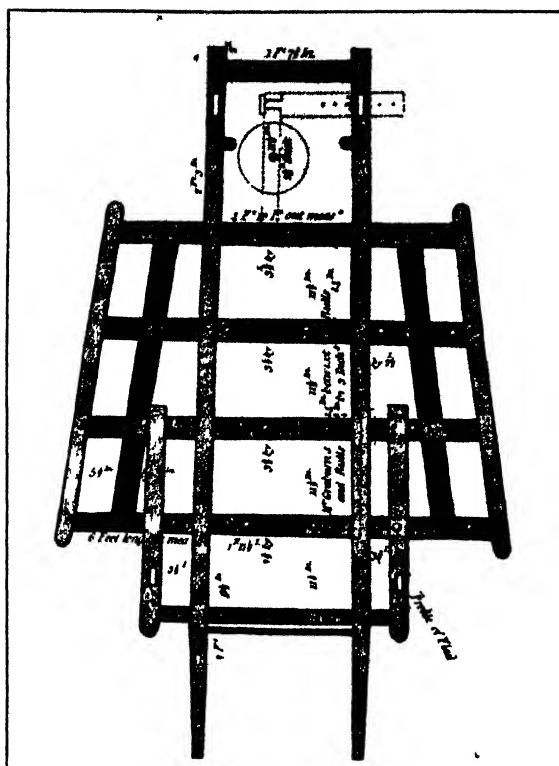
Ministry of Agriculture and Fisheries

There seem to have been some 200,000 acres of waste land in Lincolnshire at the end of the eighteenth century, but the county contained 2,748 square miles of land or about $1\frac{3}{4}$ million acres. The fenlands, still in a state of deplorable lack of cultivation at the end of the eighteenth century, amounted to a quarter of the waste, and these, and the poor sheep and cattle of the open field farms, led Ernle to a severe condemnation of the little advance agriculture had made there during the century;¹ but population advanced very slowly and the attempts at drainage had not been completely successful. Beeverell, in 1707, says that Holland was devoted to fishing and bird snaring, Kesteven was drier without being more fertile, and Lindsey was fertile in divers crops and in pasture, with abundance of birds and sheep.² Defoe, admittedly not greatly interested in agriculture, says of Lincolnshire, "As the middle of the Country is all hilly, and the West Side low, so the East Side is the richest, most fruitful and best cultivated, of any County in England, so far from London," and he was greatly impressed by the cultivation of hemp in the Fens both here and in Norfolk and Cambridge.³ The same method of alternate husbandry as in the Fens already dealt with was practised here soon after the draining, grain and rape seed being grown, while the Lincoln pippins were said to excel those of Kent.⁴ The wastes, however, were terrible to strangers, who were obliged to take a guide in crossing them, and the drowned lands excited horror in 1769.⁵ Lucerne was cultivated at Thorney, Spalding and other places in Lincoln, as it was in Cambridge, early in the century. It was recommended as a ley for burnbaked land on which two or three crops of beans, peas, Indian or common wheat or barley, followed by turnips or buckwheat, had been taken.⁶

The Wolds, which were of a piece with those of Yorkshire, grew fine barley and good grass for sheep, as well as some turnips in 1770, and the Fens were regarded as pasture, but hemp and flax were cultivated between Gainsborough and

Thorn.⁷ The barley, if we can believe Mortimer, was Scotch.⁸ There was evidently some improvement upon the old three-course system at Stamford, where a six-course rotation including turnips was prevalent and a great deal of sainfoin was grown, while at Grantham a five-course rotation was used, but paring and burning was the customary way of breaking up old grass.⁹ At Bootham, on the small farms the course was turnips, barley, rye, with sometimes peas after, and some potatoes were grown. Liming seems to have fallen into disuse here, and there was no sheep fold, but some farmers obtained stable manure from Lincoln. Oxen were no longer used for ploughing in 1771. A different system was in use on the higher lands; the meadows were fen, badly in need of draining. On the Heath farms some open-field farmers used a course of turnips, barley, wheat, peas, and turnip hoeing was beginning to be usual, although there was little or no clover. Between Lincoln and Sleaford many new enclosures were in the making when Young passed through,¹⁰ and indeed it was twenty years before then that Ellis had been asked to send a Hertfordshire ploughman to the county, because a new enclosure was being made and a good deal of land was to be ploughed up.¹¹ It was probably to the Heath that Meager referred when he spoke of the lighter implements, later cultivation and less labour required in light sandy lands having a natural fertility, such as many parts of Lincolnshire, Hampshire, etc., as well as Surrey, Suffolk and Norfolk.¹²

About the same time as Young, another traveller records that the Fens about Donington had been enclosed and "now appear in one continued field of Oats, a pleasing contrast to their former condition," and between Swineshead and Boston also some of the Fen was then already cultivated, while the remainder was about to be enclosed. The oats remarked upon were probably the result of what Young calls the vile course of three successive years of oats after paring and burning followed by rape, and then let fall down to grass, which was, however, obviously more productive than allowing the Fen land to remain in its natural state. The hemp and flax in this district are said to have been on the decline for some years. Round Boston all was grazing except for a little cultivated land devoted to oats, and Crowland was in the midst of the still undrained land. For six miles round Horncastle, too, the land was mostly arable, although somewhat depopulated owing to the enclosure of the common fields, and round Keale the field



Many farmers in the eighteenth century designed new types of implements. These illustrations are of (above) a scuffer and (below) a harrow designed by Mr. Graburn, a farmer of Lincolnshire. Reproduced from Arthur Young's *General View of the Agriculture of Lincoln*, 2nd edition, 1808.

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cultivation of potatoes for export was already carried on. This traveller also comments generally on the vast crops of oats found everywhere in the reclaimed Fens and on the improvements that had been making on Lincoln Heath, although the part north of the city was still wild, while even some new enclosures near Torksey had remained in a state of nature. On the improved Heath four or five horses were used in a plough, but in the Fens only two, and a good deal of sainfoin and some turnips were sown.^{12a}

The County Reports do not register any change from the various systems prevalent twenty years before they were written and described above. Paring and burning, oats, rape and falling down were still the practice in the Fens; the four-course system had been adopted on the heavy lands; something similar but slightly modified to meet the necessities of the case had been adopted on the Wolds and Heath; and only farmyard manure was used as a rule, the sheep fold having gone out of fashion. Potatoes were largely cultivated round Spalding and other places, and a good deal of sainfoin was grown round Lincoln. Sticklebacks were used for manure in East and West Fens.¹³

The average size of holdings in Lincoln was not large, and, indeed, we are told that in South Holland the number of small proprietors had been increasing.¹⁴ In the low country there was a good deal of copyhold and "a considerable quantity of church leases and crown lands let for years" so that it is surprising that under such security of tenure the county did not advance more rapidly.¹⁵ The common plough used in the county was known as the Dray or Drag plough,¹⁶ and the Fen plough, a special type already spoken of, is mentioned in Young's report, as is Mr. Cartwright of Brotherton's attempt to construct a reaping machine.¹⁷ The paring plough is also mentioned under the name of the Rockcliff plough.¹⁸

Rutland, the smallest county in England, occupies a tiny corner between the counties of Lincoln, Leicester and Northampton. We learn little of it except that it was fertile,^{18a} until 1770, when it had a good wheat soil and was well enclosed, half the county being under tillage and some turnips being grown.¹⁹ The farms in the county were not large, although of greater extent in the enclosed part of the county than in the open fields. A great many gentlemen farmed part of their lands and some the whole, and these must be the respectable class of yeoman referred to by Taylor²⁰ as being common to

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the whole midland district, including Leicester, Rutland, Warwickshire, with the northern margin of Northants, the eastern portion of Staffordshire, and the south extremities of Derby and Nottingham.

In the open fields the three-course rotation was followed, but some turnips had been introduced: on the enclosed land the Norfolk four-course system had been adopted. Some wheat was sold to Leicestershire for seed; this was the Red Lammas. Potatoes had been introduced and were much cultivated when the report was written, while the use of lime on the grass land was common, and applications of eighty bushels an acre were made, while some draining had been done. The reporter states that in the height of the enclosure movement, about 1760, some land was turned to grass, but that the open field remained arable. Some of the less favourable enclosed land was, however, under the deplored system of alternative husbandry.²¹

REFERENCES.

- ¹ *English farming past and present*, pp. 237, 238, 245-249. ² *Les délices de la Grande Bretagne*, 1707, p. 164. ³ *Tour*, 4th ed., 1753, III, pp. 11, 25. ⁴ Herman Moll, *New Description* . . . 1724, p. 187; *New General Atlas*, 1721, p. 217, and other topographers. ⁵ *Description of England and Wales*, 1769, V, pp. 228, 232. ⁶ Stephen Switzer, *A dissertation* . . . 1731, p. 38. ⁷ Charles Varlo, *New System* . . . 1770, p. 125. ⁸ *Whole art of husbandry*, 1707, p. 600 ff. ⁹ Young, *Northern Tour*, 2nd ed., 1770, I, pp. 64, 84. ¹⁰ *Eastern Tour*, 1771, I, pp. 433-462. ¹¹ *Modern Husbandry*, 1750, I, Jan., p. 119. ¹² *Mystery of Husbandry*, 1697, p. 68. ^{12a} T. Q., *A tour in the Midland Countes* . . . in . . . 1772; *Gents. Magazine*, XLIV, pp. 206, 208, 209, 253, 254, 299, 410. ¹³ Thos. Stone, *Report*, 1794, pp. 15, 16, 26, 38, 39, 42; A. Young, *Report*, 1799, pp. 95, 96, 98 ff., 121, 142, 147, 250; see also *Annals*, VIII (1787), p. 168; Thos. Stone, *Essay on Agriculture*, 1785, p. 186 ff.; Young, *Political Essays*, 1772, p. 129. ¹⁴ Young, *Report*, 1799, p. 39; Hy. Chas. Taylor, *Decline of landowning farmers*, 1904, p. 32. ¹⁵ Young, *ibid.*, p. 21; Taylor, *Introduction* . . . 1905, p. 292. ¹⁶ Hale, *Compleat Farmer*, 1756, p. 289 ff. ¹⁷ *Ibid.* pp. 69, 70. ¹⁸ Thomas Hitt, *A treatise on husbandry*, 1760, p. 126. ^{18a} See the topographers. ¹⁹ Charles Varlo, *op. cit.*, p. 129. ²⁰ *Decline* . . . 1904, p. 33, citing Marshall; see also John Crutchley, *County Report*, 1794, p. 8; and *Annals*, XXII (1794), p. 354. ²¹ Crutchley, *op. cit.*, pp. 8-12, 30; *Annals*, *ibid.*, pp. 355, 357, 359, 360.

ECONOMICS OF TURKEY PRODUCTION

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During the past four years the weight and value of dead turkeys imported into Great Britain were as follows:—

				cwt.	£
1933	..	..	..	255,709	1,014,797
1934	..	..	..	261,098	916,669
1935	..	..	..	219,509	941,594
1936	..	..	..	216,045	(not yet available)

The total imports have shown a decrease, and there is considerable scope for the expansion of the home production of turkeys. Home-produced turkeys are generally recognized to be of superior quality to those imported and invariably command higher prices. The prices received by home producers during the last few years have been, generally speaking, satisfactory, and turkey rearing has been a profitable occupation for those who were able to rear and market a high percentage of good quality birds. The ordinary outdoor method of rearing involves risks of losses, however, particularly on specialized poultry farms, through attacks of Blackhead disease.

Experiments (1, 2, 3,)* carried out at the National Institute of Poultry Husbandry during the last five years have demonstrated that land heavily stocked with poultry is unsuitable for normal methods of turkey rearing, but that an intensive system, in which the birds have no contact with the soil, will give very satisfactory results. Under the intensive system, the risks of blackhead infection and losses from the disease can be reduced very considerably.

Until recent years, the popular demand was for large turkeys, but changing conditions have created a very considerable demand for smaller birds. The question of the relative profitability of large and small birds, to the producer, has thus become one of practical importance, and it was to obtain information on this point that the experiment herein described was carried out at the Institute.

* For references see p. 666.

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Two breeds of turkeys, the American Mammoth Bronze and the smaller Black Norfolk, were used. In order to obtain more complete information, a group of each breed was hatched at the end of May and another early in July.

Scheme of Experiment. A total of 146 day-old poults, comprising 66 American Mammoth Bronze and 80 Black Norfolk, was used in two hatches. Hatch 1 consisted of 38 poults of each breed hatched on May 28, 1936, and Hatch 2 consisted of 28 American Mammoth Bronze and 42 Black Norfolk poults hatched on July 8, 1936.

Brooding. The management of both hatches was identical. Each group was brooded under a 200 chick, electric hover, in a 12-ft. by 10-ft. compartment of a sectional brooder house. The brooder temperature during the first week was maintained at approximately 90° F. at one inch from the floor at the outer edge of the hover; thereafter, the temperature was gradually reduced until heat was discontinued at the end of six weeks. The birds were confined near the hover during the first week to prevent chilling; after this they were given access to the whole compartment. They were kept intensively during the whole brooding period, but had access at two weeks to a 12-ft. by 4-ft. sun-porch.

Rearing. At 8 weeks each breed of Hatch 1 was transferred to a 14-ft. by 10-ft. colony house fitted with a 10-ft. by 4-ft. sun-porch. Perches were provided at 12 weeks, and, at 14 weeks, half of the poults from each house were transferred to two similar houses.

Hatch 2 remained in the brooder house throughout the entire rearing period, and at 14 weeks each breed had access to a double compartment but perches were not provided. The birds of both hatches were kept intensively throughout the entire period.

Feeding. During the first four weeks, the poults were fed on a grain mixture morning and evening, and wet mash four times daily. Thereafter, they were given dry mash *ad lib.* with two supplementary feeds of wet mash, and the usual morning and evening grain feeds. During the first eight weeks, a liberal amount of chopped clover was included in the wet mash. After the brooding stage, weighed amounts of marrowstem kale were fed to all the birds daily. The kale was hung up at a suitable height according to the size of the birds. During

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the final fattening period of one month, the birds were given a growers dry mash *ad lib.*, a fattening wet mash daily, green food, and grain in the morning. From day-old onwards, the birds could take oyster shell at will.

RATIONS (PARTS BY WEIGHT)

Ingredient	MASH	
	0-8 weeks	Growers
Maize meal	20	20
Weatings	35	35
Bran	14	20
Sussex ground oats	10	10
Lucermel	—	5
Meat meal (60 per cent. protein)	3	—
Soya bean meal	5	6
Dried skim milk	5	3
Salt	1	1
Cod-liver oil	2	—

GRAIN	
0-6 weeks	6 weeks to fattening
Pinhead oatmeal .. 1	Wheat 1
Maize grits 1	Kibbled maize 1
Cut wheat 1	

FATTENING RATION	
Mash	Grain
Maize meal 30	Wheat 1
Barley meal 30	Kibbled maize 1
Sussex ground oats 30	
Soya bean meal 5	
Dried skim milk 5	
Salt 1	

Results of Experiment: Growth Rate. The average weights of the American Mammoth Bronze and Black Norfolk poults for each group at day-old and at intervals of four weeks are given in Table 1.

The rate of growth of the American Mammoth Bronze poults in both hatches was satisfactory and compared favourably with that obtained in previous years. The growth rate of the

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TABLE I

AVERAGE WEIGHTS OF AMERICAN MAMMOTH BRONZE AND BLACK NORFOLK POULTS

	HATCH 1				HATCH 2			
	A.M.B.		B.N.		A.M.B.		B.N.	
	Males	Females	Males	Females	Males	Females	Males	Females
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
Day-old	0 2.4	0 2.2	0 1.9	0 1.9	0 2.4	0 2.4	0 1.8	0 2.1
4 weeks	0 10.8	0 10.1	0 8.4	0 9.1	0 11.2	0 10.3	0 7.9	0 8.5
8 "	2 9.0	2 2.0	2 2.0	1 13.0	2 9.0	2 2.0	2 5.0	1 14.0
12 "	5 9.0	4 7.0	4 10.0	3 14.0	5 3.0	4 3.0	4 10.0	3 6.0
16 "	9 9.0	7 8.0	8 0.0	6 9.0	9 2.0	7 3.0	8 15.0	6 8.0
20 "	13 6.0	9 9.0	12 1.0	8 12.0	12 4.0	9 13.0	12 3.0	8 10.0
23 "	—	—	—	—	13 13.0	10 12.0	12 11.0	9 6.0
24 "	16 7.0	11 8.0	15 9.0	10 9.0	—	—	—	—
28 "	20 10.0	12 14.0	18 10.0	12 4.0	—	—	—	—

Black Norfolks throughout was slightly less than that of the American Mammoth Bronze poults. In Hatch 1, at 28 weeks, the American Mammoth Bronze males averaged 20 lb. 10 oz., and the Black Norfolk males 18 lb. 10 oz., the American Mammoth Bronze females averaged 12 lb. 14 oz., and the Black Norfolk females 12 lb. 4 oz. In Hatch 2, at 23 weeks, the American Mammoth Bronze males averaged 13 lb. 13 oz., and the Black Norfolk males 12 lb. 11 oz.; the American Mammoth Bronze females averaged 10 lb. 12 oz., and the Black Norfolk females 9 lb. 6 oz.

Mortality. The losses during the brooding stage in Hatch 1 were three Black Norfolks; and, in Hatch 2, one American Mammoth Bronze and four Black Norfolks. The losses for the whole period are given in Table II.

TABLE II

MORTALITY FROM DAY-OLD TO MARKETING

			HATCH 1		HATCH 2	
			A.M.B.	B.N.	A.M.B.	B.N.
No. of birds at start	..		38	38	28	42
No. of deaths	..	..	6	7	3	4
Percentage mortality	..		15.8	18.4	10.7	9.5

The mortality in both breeds was fairly high in the first hatch, owing to a slight outbreak of blackhead disease at 12 weeks. This was probably introduced on the attendant's

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boots, as the surrounding ground is known to be highly infected with blackhead organisms. The mortality was checked by daily removal of the litter and disinfection of boots before entering the houses. The available data do not warrant any conclusions as to the relative mortality of the two breeds, but in the early stages the Black Norfolks appeared weaker and required more careful management.

Food Consumption and Cost. Table III gives a summary of the mash and grain consumption in ounces per poult per day for each period.

TABLE III

MASH AND GRAIN CONSUMPTION PER BIRD PER DAY FOR EACH GROUP

Period (weeks)	HATCH 1						HATCH 2					
	A.M.B.			B.N.			A.M.B.			B.N.		
	Mash	Grain	Total	Mash	Grain	Total	Mash	Grain	Total	Mash	Grain	Total
1-4	0 ⁰⁸ .78	0 ⁰⁸ .07	0 ⁰⁸ .85	0 ⁰⁸ .63	0 ⁰⁸ .02	0 ⁰⁸ .65	0 ⁰⁸ .90	0 ⁰⁸ .04	0 ⁰⁸ .94	0 ⁰⁸ .63	0 ⁰⁸ .04	0 ⁰⁸ .67
5-8	3.0	0.06	3.06	2.6	0.06	2.66	3.33	0.14	3.47	2.66	0.11	2.77
9-12	5.1	0.3	5.4	2.9	0.2	3.1	5.9	0.4	6.3	4.8	0.4	5.2
13-16	7.1	0.5	7.6	6.6	0.5	7.1	8.3	0.5	8.8	8.4	0.3	8.7
17-20	7.4	0.6	8.0	8.8	0.6	9.4	11.8	0.9	12.7	9.9	0.6	10.5
21-23	—	—	—	—	—	—	9.3	1.0	10.3	7.6	0.8	8.4
24-26	13.3	1.9	15.2	13.2	1.7	14.9	—	—	—	—	—	—
27-28	9.9	1.1	11.0	9.6	1.2	10.8	—	—	—	—	—	—

The food consumption per day in Hatch 1 was considerably higher for the American Mammoth Bronze poults than for the Black Norfolks during the first 12 weeks, but thereafter the food consumption was very similar for both breeds. The food consumption per day in Hatch 2 was considerably higher for the American Mammoth Bronze poults at all stages except from 13 to 16 weeks. The food consumption for both breeds in the two hatches was at a maximum in the penultimate period.

Table IV gives a summary of the average cost and consumption of mash and grain, green food and oyster shell, per bird reared, in Hatches 1 and 2.

In Hatch 1 the average food consumption of mash and grain for the American Mammoth Bronze poults was 89.2 lb. at a cost of 6s. 9½d., whereas, the Black Norfolks consumed 81.9 lb. of food at a cost of 6s. 3½d. In Hatch 2, the corresponding figure for the American Mammoth Bronze turkeys was 73.7 lb. at a cost of 5s. 7½d., whereas the Black Norfolks consumed 59.8 lb. at a cost of 4s. 7½d. In Hatch 1, the average cost of

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TABLE IV

SUMMARY OF FOOD CONSUMPTION AND COSTS PER BIRD REARED

	Hatch 1		Hatch 2	
	A.M.B.	B.N.	A.M.B.	B.N.
Length of period (weeks) ..	28	28	23	23
Total number of turkeys reared	32	31	25	38
Average consumption of mash and grain	89.2 lb.	81.9 lb.	73.7 lb.	59.8 lb.
Average cost of mash and grain	6s. 9½d.	6s. 3½d.	5s. 7½d.	4s. 7½d.
Average cost of green food ..	3½d.	3d.	1½d.	¾d.
Average consumption of oyster shell	2.6 lb.	2.7 lb.	2.9 lb.	3.2 lb.
Average cost of oyster shell	1d.	1d.	1½d.	1½d.
Average cost of total food per poult reared	7s. 2d.	6s. 7½d.	5s. 10d.	4s. 9½d.
Average cost of food per lb. of live turkey	5½d.	5½d.	5½d.	5½d.

all the food, including oyster shell and green food, was 6d. less for each Black Norfolk reared; in Hatch 2, the Black Norfolks cost 1s. 0½d. less for food than the American Mammoth Bronze poults. The average cost of food per pound of live turkey in Hatch 1 was 5½d. for both breeds; in Hatch 2 the corresponding food cost was 5¾d. for the American Mammoth Bronze turkeys and 5½d. for the Black Norfolks.

Marketing. In order to obtain more complete information on the relative values of the different breeds and weights, some birds were sold plucked on the Smithfield Market, others were sold alive in the local market and the remainder were sold to private customers.

Table I gives the average weight of the males and females in the first hatch on December 9, and the average weight of the males and females in the second hatch on December 16.

Table V gives a summary of the numbers and total starved live weights of birds of each breed sent to the London Market, the total amounts received, the average weight and price per poult and the average price per lb.

The Black Norfolk turkeys realized 1½d. per lb. more than the American Mammoth Bronze poults. All the birds were of good quality, but the Black Norfolks were slightly better fleshed, this probably being the reason for the better returns.

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TABLE V
LONDON MARKET RETURNS

	American Mammoth Bronze	Black Norfolks
Number of birds	22	24
Total starved weight	324½ lb.	306 lb.
Total receipts	£23 15s. 7d.	£23 15s. 11d.
Average weight of poults	14.75 lb.	12.75 lb.
Average price per poult	£1 1s. 7½d.	19s. 10d.
Average price per lb. (live-weight) ..	1s. 5½d.	1s. 6½d.

In Table VI, the London Market data have been rearranged on the basis of size, regardless of breed. The small turkeys ranged from 9 lb. to 12 lb. and the large turkeys from 14 lb. to 24 lb.

TABLE VI
LONDON MARKET RETURNS FOR LARGE AND SMALL TURKEYS

	Large Turkeys	Small Turkeys
Number of turkeys	23	23
Total starved weight	388½ lb.	242 lb.
Total receipts	£29 2s. 11d.	£18 8s. 7d.
Average weight per poult	16.9 lb.	10.5 lb.
Average price per poult	£1 5s. 4d.	16s. 0½d.
Average price per lb.	1s. 6d.	1s. 6½d.

The average price received for the larger turkeys, average weight 16.9 lb., was 1s. 6d. per lb. and the average price for the smaller turkeys, average weight 10.5 lb., was 1s. 6½d. From the reports received from the London salesmen, it would appear that the small difference in returns from the large and small turkeys was entirely due to the quality. The reports indicated that large turkeys sold as readily as small ones of similar quality.

Table VII gives a summary of the numbers of each breed sold alive in the local auction market, the total weights and the prices obtained.

The returns from the local auction market were again better for the Black Norfolks, which brought 1½d. per lb. more than the American Mammoth Bronze, partly owing to better demand on account of their smaller size, and partly to their slightly better quality.

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TABLE VII LOCAL MARKET RETURNS

	American Mammoth Bronze	Black Norfolks
Number of turkeys	23	20
Total starved weight	308½ lb.	246½ lb.
Total receipts	£20 1s. 0d.	£17 13s. 0d.
Average weight	13.4 lb.	12.3 lb.
Average price per bird	17s. 5d.	17s. 7½d.
Average price per lb.	1s. 3½d.	1s. 5½d.

Table VIII gives a summary of the returns obtained at the local auction market for birds of different weights.

TABLE VIII LOCAL MARKET RETURNS FOR POULTS OF DIFFERENT SIZES

Weight in lb.	Over 14 lb.	All birds 13 lb. and over	All birds under 13 lb.	All birds 11½ lb. and under
Number of birds	11	20	23	11
Average weight (lb.)	15.7	14.6	11.4	10.5
Average price per lb.	1s. 2d.	1s. 3½d.	1s. 5½d.	1s. 6½d.

The returns from this market show very clearly that there was a marked preference for small birds up to 13 lb.; large birds of the very best quality were not in demand and realized lower prices per lb. than small birds of the same quality.

The remaining birds were all sold privately at a flat rate of 1s. 6d. per lb. (starved weight).

Table IX gives a summary for each hatch of the average starved weights of the American Mammoth Bronze and Black Norfolk when marketed; the average returns per bird, the cost of food per bird reared, the margin of profit over food cost per turkey, and the average margin of profit over food cost per lb. of turkey reared.

The average weight of the American Mammoth Bronze turkeys in Hatch 1 was 1 lb. 9 oz. greater than that of the Black Norfolks. In Hatch 2, the American Mammoth Bronze poults were 15 oz. heavier than the Black Norfolks. It is difficult to compare the average weights of the two breeds from the above tables owing to unequal numbers of males and females in each breed, but Table 1 shows clearly that both

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TABLE IX
SUMMARY OF AVERAGE RETURNS AND FOOD COSTS

	HATCH 1		HATCH 2	
	A.M.B.	B.N.	A.M.B.	B.N.
Number of turkeys ..	32	31	25	38
Weight of turkeys sold	485 lb.	422 lb. 10 oz.	290 lb.	405½ lb.
Average weight per bird	15 lb. 3 oz.	13 lb. 10 oz.	11 lb. 10 oz.	10 lb. 11 oz.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Total receipts ..	33 2 10	31 6 9	21 4 11	30 15 3
Average receipts per bird	1 0 8½	1 0 2½	0 17 0	0 16 2½
Average cost of food ..	0 7 2	0 6 7½	0 5 10	0 4 9½
Average profit per bird over food cost ..	0 13 6½	0 13 6½	0 11 2	0 11 4½
Average selling price per lb. of turkey ..	0 1 4½	0 1 5½	0 1 5½	0 1 6½
Average cost of food per lb. of turkey ..	0 0 5½	0 0 5½	0 0 5½	0 0 5½
Average profit over food cost per lb. of turkey	0 0 11	0 1 0½	0 0 11½	0 1 1

the American Mammoth Bronze males and females in each group were appreciably heavier than the corresponding Black Norfolks. The average receipt per bird in Hatch 1 was £1 os. 8½d. for the American Mammoth Bronze and £1 os. 2½d. for the Black Norfolks; in Hatch 2, American Mammoth Bronze realized 17s., and the Black Norfolks 16s. 2½d.

In Hatch 1 both breeds made lower prices per lb. of turkey but realized a greater return per bird on account of the greater weights. The average profit over food costs per lb. of turkey in each hatch was 1¼d. more for the Black Norfolks than for the American Mammoth Bronze. The average margin per bird over food cost in Hatch 1 was 13s. 6½d. for the American Mammoth Bronze and 13s. 6½d. for the Black Norfolks; in Hatch 2, the margin was 11s. 2d. for the American Mammoth Bronze and 11s. 4½d. for the Black Norfolks.

Shrinkage Losses. Information respecting the shrinkage losses is available for 12 American Mammoth Bronze and 12 Black Norfolk poults sold privately. The percentage losses in plucking and dressing are given in Table X.

The percentage losses in plucking the American Mammoth Bronze poults ranged from 6.3 to 15.0; the corresponding figures for the Black Norfolk ranged from 4.1 to 10.6. The average losses were 11.1 per cent. and 7.4 per cent. respectively. There appeared to be no relationship between the weight and percentage loss in either breed. The total losses in plucking

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TABLE X
PERCENTAGE LOSSES IN PLUCKING AND DRESSING

Breed	Average weight	Loss in plucking	Total loss, feathers, head, feet, intestines and giblets*
American Mammoth		per cent.	per cent.
Bronze	12.3 lb.	11.1	32.5
Black Norfolk	10.1 lb.	7.4	31.9

* The giblets include neck, gizzard, liver and heart.

and dressing the American Mammoth Bronze poultS ranged from 23.6 to 40.2 per cent., the corresponding range in the Black Norfolks being 29.2 to 35.0 per cent. The average total loss in the American Mammoth Bronze poultS was 32.5 per cent. and in the Black Norfolks 31.9 per cent. Again, there appeared to be no relationship between the weight and percentage loss in either breed.

Summary. Details are given of the growth rate, mortality, food consumption and returns from American Mammoth Bronze and Black Norfolk turkeys hatched at the end of May and the beginning of July, 1936. All the birds were reared intensively.

In Hatch 1, at 28 weeks of age, the average weight of the American Mammoth Bronze males was 20 lb. 10 oz. and the females 12 lb. 14 oz.; at the same age the Black Norfolk males were 18 lb. 10 oz. and the females 12 lb. 4 oz. In Hatch 2, at 23 weeks, the average of the American Mammoth Bronze males was 13 lb. 13 oz. and the females 10 lb. 12 oz.; at the same age, the Black Norfolk males were 12 lb. 11 oz. and the females 9 lb. 6 oz. The rate of growth at different stages and the final weights show that the American Mammoth Bronze males and females are appreciably heavier than the corresponding Black Norfolks. The available data do not indicate that there is any difference in mortality in the two breeds, but the Black Norfolks appeared more delicate and were more difficult to rear during the brooding period. The total losses in rearing the American Mammoth Bronze poultS was 13.6 per cent.; the Black Norfolk mortality was 15.7 per cent. The mortality would have been considerably lower if there had not been an outbreak of Blackhead disease in Hatch 1. This

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disease was checked in Hatch 1, and prevented in Hatch 2 by strict attention to hygiene and precaution against the introduction of further outside infection.

The average food consumption per poult reared was higher in the American Mammoth Bronze group but there was less difference in the food utilization, i.e., the amount of food consumed per lb. of live-weight gain. In Hatch 1 the average consumption of mash and grain per lb. of live turkey was 5.6 lb. for the American Mammoth Bronze and 5.7 lb. for the Black Norfolks. In Hatch 2, the average consumption of mash and grain per lb. of live turkey was 6.1 lb. for the American Mammoth Bronze and 5.4 lb. for the Black Norfolk turkeys. The average cost of all food consumed per lb. of turkey produced was $5\frac{1}{2}d.$ for both breeds in the early hatch and $5\frac{3}{4}d.$ for the American Mammoth Bronze and $5\frac{1}{4}d.$ for the Black Norfolks in the later hatch.

There was little difference in quality between the two breeds, but, on the average, the Black Norfolks were slightly better fleshed than the American Mammoth Bronze. The early-hatched birds, especially the American Mammoth Bronze, were inclined to be rather "leggy" and contained fewer really first-class birds; this difference is shown by the better prices per lb. received for both breeds hatched in July.

The losses in plucking 12 birds of each breed indicated that the American Mammoth Bronze poults carried a higher percentage of feathers. The percentage shrinkage losses (including giblets) were very similar for both breeds, the losses being very similar to those obtained in dressing table poultry.⁴

The returns from birds sold in London and the local markets indicated that prices vary very considerably in different markets. In the local market small birds (13 lb. and under) made better prices than larger birds, whereas in London there was very little difference in the prices received for birds of various weights. From a survey of the prices obtained in different markets, it would appear that there is a good market for a limited number of first quality heavy birds, but at the same time the demand for such birds is easily met by home supplies. The larger birds are in demand for catering, but such birds are no longer in demand by the average house-wife. The small or medium-sized birds are more suitable for the present-day small family, which cannot readily consume very large birds; further, modern ovens are too small for roasting large birds.

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Both breeds gave a very satisfactory margin of profit over food costs. In both hatches, there was no appreciable difference between the two breeds in the profits over food costs per bird reared. The early-hatched birds of both breeds proved more profitable than those hatched later; the American Mammoth Bronze poult hatched in May gave 2s. 4½d. more profit than those hatched in July, and the early-hatched Black Norfolks gave 2s. 2d. more than those hatched at a later date. The above figures show that turkey production can be a profitable undertaking. Maximum profits, however, can only be obtained by making a careful study of market requirements. There is still room for considerable expansion in the home production of turkeys, but it is doubtful if there is an economic market for a considerable expansion in the production of large birds.

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Milk Acts 1934 to 1937: *Manufacturing Milk.* Advances made by the Ministry up to September 15, 1937, in respect of manufacturing milk were as follows:—

Section of Act		Period of Manufacture	Quantity	Advances
	<i>(a) Milk Marketing Board for England and Wales</i>			
	In respect of milk :			
1	Manufactured at factories other than the Board's	April, 1934, to March, 1937	524,218,802	£ 2,243,346
2	Manufactured by the Board ..	April, 1934, to March, 1937	10,157,541	36,691
3	Made into cheese on farms ..	April, 1934, to March, 1937	45,598,022	196,317
	Total for England and Wales * ..		579,974,365	2,476,354
	<i>(b) Government of Northern Ireland</i>			
6	In respect of milk : Manufactured into cream and butter at registered creameries ..	April, 1934, to June, 1937	72,976,311	405,492
	TOTAL ..		652,950,676	2,881,846

* Owing to the Cheese-Milk Prices for April to July, 1937 (inclusive), being in excess of the Standard Price, no advances are payable in respect of milk produced and manufactured in these months.

Milk in Schools Scheme. The following figures show the gallonage of milk consumed in the first nine months of the third year of the scheme compared with the corresponding period in the first and second years. The figures for the third period will be slightly increased when further returns are received.

	Gallons	Exchequer Contribution
October, 1934, to June, 1935 ..	18,586,830	£364,556
October, 1935, to June, 1936 ..	17,536,802	£357,079
October, 1936, to June, 1937 ..	17,889,666	£367,587

Wheat Act; 1932: Sales of Home-grown Wheat—Cereal Year, 1937-38. Certificates lodged with the Wheat Commission by registered growers during the period August 1 to September 3, 1937, cover sales of 444,868½ cwt. of millable wheat, as compared with 284,742½ cwt. in the corresponding period (to September 4) in the last cereal year.

Anticipated Supply for the Cereal Year, 1937-38, and new Quota Payments Order. The Minister (on the recommenda-

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tion of the Wheat Commission) has made Orders giving an estimate of the supply of home-grown millable wheat in the cereal year 1937-38 and re-imposing the quota payment which every miller and every importer of flour is liable to make to the Wheat Commission in respect of each hundredweight of his output of flour. The Wheat (Anticipated Supply) No. 2 Order, 1937, estimates the quantity of home-grown millable wheat of their own growing that will be sold by registered growers during the cereal year 1937-38 at 26,000,000 cwt. By the Wheat (Quota Payments) No. 3 Order, 1937, the Minister has, in the light of estimates furnished by the Wheat Commission and of the surplus in the Wheat Fund at July 31, 1937, prescribed that the quota payment in respect of deliveries of flour during the period commencing on September 19, 1937, shall be 2.4d. per cwt. (equivalent to 6d. per sack of 280 lb.). This Order supersedes the Wheat (Quota Payments) No. 2 Order, 1937, under which quota payments were suspended as from April 18, 1937.

Copies of the present Orders—Statutory Rules and Orders, 1937, Nos. 831 and 823—can be obtained from H.M. Stationery Office, or through any bookseller, price 1d. each, post free 1½d.

Appointment of Member of Wheat Commission. Mr. C. E. Palmer, one of the members of the Wheat Commission representing the interests of consumers of flour, has resigned owing to pressure of business, and Mr. Philip Carr, of Petersham, Surrey, has been appointed in his place.

Final Deficiency Payment to Wheat Growers for 1936-37. The Wheat Commission despatched cheques on September 10 to 81,902 registered growers in respect of the final payment of deficiency payments for the cereal year 1936-37. The aggregate amount involved was approximately £768,350, but, after taking into account 694 further payments which, for various reasons, have had to be delayed pending investigations of the title of persons claiming deficiency payments by the Commission, the amount disbursed in this final payment will amount to approximately £777,000.

This will bring the total deficiency payments for the year, including the advance payment made in April, 1937, to approximately £1,337,000, or an average of just over £16 per grower. The deficiency payment for 1936-37 is equivalent to 1s. 1.53d. per cwt. (approximately 5s. 1d. per quarter) in respect of all sales of wheat credited to growers for that year from wheat -certificates delivered to the Wheat Commission.

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Approximately 23,713,000 cwt. of millable wheat were sold by the 82,596 growers who have qualified for deficiency payments, and 174,040 certificates relating to the sales of this wheat were delivered to the Wheat Commission.

Sugar Industry (Reorganization) Act, 1936: *Accounts of British Sugar Corporation, Ltd.* The Minister, with the consent of the Treasury, has made the Sugar Industry (Accounts of British Sugar Corporation) Rules, 1937 (S.R. & O. 1937, No. 782), prescribing the accounts of the Corporation to be included in the Report that the Sugar Commission are required by Section 28 of the Act to submit annually to the Minister.

Cattle Fund. The following table gives particulars of payments made out of the fund set up under the Cattle Industry (Emergency Provision) Acts 1934 to 1936, and the Livestock Industry Act 1937.

<i>Period</i>	<i>Payments</i>	<i>Animals</i>	<i>Average Payment per Animal</i>		
			<i>£</i>	<i>s.</i>	<i>d.</i>
April to August, 1935 ..	1,528,896	646,793	2	7	3
April to August, 1936 ..	1,583,829	681,345	2	6	6
April to August, 1937* ..	1,529,908	651,671	2	6	11
From commencement of subsidy payments to August 31, 1937	11,409,951	4,819,528	2	7	4

* The August, 1937, payments comprised £88,853 for 38,354 animals certified under the Emergency Provision Acts and £91,227 for 29,117 animals of quality standard and £82,918 for 41,771 of ordinary standard certified under the 1937 Act.

Milk Marketing Scheme: Milk Contract Prices 1937-38. The prices and other terms of the wholesale milk contract to operate for the period October 1, 1937, to September 30, 1938, have been agreed between the Milk Marketing Board and the Central Milk Distributive Committee, representing purchasers of milk by wholesale, and the contract has been prescribed by the Board.

The monthly wholesale prices of milk for liquid consumption are to be as follows:—1s. 5d. per gal. in October, 1s. 6d. from November to February, 1s. 5d. in March, 1s. 4d. in April, 1s. 1d. from May to July, and 1s. 3d. in August and September, giving an average price of 15s. 11d. per 12 gal. over the year, an increase of 8d. on the 1936-37 average price. An additional $\frac{1}{4}$ d. per gal. is to be paid on purchases during May, 1938, being the distributors' share of a joint contribution of $\frac{1}{4}$ d. per gal. for milk publicity. The corresponding yearly prices in each year since the commencement of the Scheme have been as follows:—

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1933-34	14s. 4d.	per 12 gallons in the S.E. region.
			13s. 9d.	.. 12 .. other regions.
1934-35	15s. 1d.	.. 12 .. all regions.
1935-36	..	..	15s. 3d.	.. 12 .. "
1936-37	..	..	15s. 3d.	.. 12 .. "

Appropriate minimum retail prices have been prescribed which show an increase of 2d. or 4d. per gal. in certain months and represent a total increase of 1s. per dozen gallons on those operating in 1936-37. The prices are as follows:—

	Urban District or Borough of less than 10,000 inhabitants or Rural District		Urban District, Borough or County Borough exceeding 10,000 but not exceeding 25,000 inhabitants		Urban District, Borough or County Borough exceeding 25,000 inhabitants outside S.E. Region		City of London and Metropolitan Police District or Urban District, Borough or County Borough exceeding 25,000 inhabitants within the S.E. Region	
	s.	d.	s.	d.	s.	d.	s.	d.
October	..	2 0	..	2 4	..	2 4	..	2 4
November	..	2 0	..	2 4	..	2 4	..	2 6
December	..	2 2	..	2 4	..	2 4	..	2 6
January	..	2 2	..	2 4	..	2 4	..	2 6
February	..	2 0	..	2 4	..	2 4	..	2 6
March	..	2 0	..	2 4	..	2 4	..	2 4
April	..	2 0	..	2 0	..	2 4	..	2 4
May	..	2 0	..	2 0	..	2 0	..	2 0
June	..	2 0	..	2 0	..	2 0	..	2 0
July	..	2 0	..	2 0	..	2 0	..	2 0
August	..	2 0	..	2 0	..	2 4	..	2 4
September	..	2 0	..	2 0	..	2 4	..	2 4

The provision for the sale of milk at the farmhouse door at 1d. per quart less than the appropriate minimum is continued.

Prices of all milk used for manufacture are to be increased in the new contract. The formulae for ascertaining the prices to be paid monthly for milk manufactured into cheese and butter are given below:

Product

1. (a) CHEESE (other than soft curd cheese, cream cheese, Stilton cheese and Blue Vein cheese) manufactured from milk delivered in the months of October, 1937, to February, 1938 (inclusive), and September, 1938.

Price per Gallon

The weighted average less 1½d. of (1) the average price per lb. for the previous month of Finest White New Zealand Cheese, and (2) the average of (a) the average price per lb. for the previous month of Finest White Canadian cheese (excluding old and exceptional quotations), and (b) the average price per lb. for the previous month of Finest White Canadian Cheese New Season's Make, and to the resultant price there shall be added one halfpenny.

The "weights" to be used are the total imports of New Zealand and Canadian cheese, respectively, in the month preceding the "previous month."

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Product

(b) CHEESE (other than soft curd cheese, cream cheese, Stilton cheese and Blue Vein cheese) manufactured in other months.

(c) STILTON CHEESE and Blue Vein cheese.

2. SOFT CURD CHEESE AND CREAM CHEESE.

3. BUTTER.

Price per Gallon

The average price per lb. for the previous month of Finest White New Zealand Cheese, less the sum of $1\frac{1}{4}d.$ per lb.

One penny per gallon more than the manufacturing price for cheese (other than soft curd cheese and cream cheese).

$8\frac{1}{4}d.$

For milk produced outside the County of Cornwall. The weighted average price per cwt. in the previous month of New Zealand Finest and Danish butter (excluding exceptional quotations and quotations for unsalted butter) less 16s., divided by 265 from October, 1937, to February, 1938 (inclusive), and in September, 1938, and by 285 from March to August, 1938 (inclusive), plus six-tenths of a penny (which is to include one half-penny allowance for the value of separated milk).

The "weights" to be used are the total imports of New Zealand and Danish butter respectively, in the month preceding the "previous month."

For milk produced in the County of Cornwall. The above weighted average price of imported butter less 16s. divided by 225 from October, 1937, to February, 1938 (inclusive), and in September, 1938, and by 245 from March to August, 1938 (inclusive), plus one-tenth of a penny.

The prices for milk manufactured into condensed milk and into milk powder are $7\frac{1}{2}d.$ and $7d.$ per gal. respectively, fresh and bottled cream $8\frac{1}{2}d.$ per gal., tinned cream $7d.$ from October 1 to December 31, 1937, and from January 1, 1938, $7\frac{1}{2}d.$ per gal., ice cream $8\frac{1}{2}d.$ per gal., exported natural sterilized milk $7\frac{1}{2}d.$ per gal., and other products $10d.$ per gal. If any condensed milk is exported the price is to be reduced to the manufacturing price, for the month in which the milk was delivered, of hard cheese (other than Stilton and Blue Vein cheese) but with a minimum of $5d.$ per gallon.

A premium of $1d.$ per gal. over the above-mentioned prices is to be paid for milk used for manufacture in the Metropolitan Police District or the City of London. For milk manufactured,

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in other towns and cities with more than 60,000 population, into a product for which the scheduled price is less than $8\frac{1}{2}d.$ per gallon the manufacturing price is to be increased by $\frac{1}{2}d.$ per gallon or such smaller sum as is necessary to bring the manufacturing price up to $8\frac{1}{2}d.$ per gallon.

The level delivery premiums of $1d.$ per gal. for exact daily deliveries and $\frac{1}{2}d.$ per gal. for daily deliveries with a maximum variation of 10 per cent. are continued.

Tuberculin Tested Milk. A separate form of contract, in substantially the same form as the ordinary contract, except as regards prices, has been prescribed by the Board for sales by wholesale of Tuberculin Tested Milk. In this contract the regional price in each month is $2d.$ per gal. higher than that prescribed for ordinary milk.

Appropriate minimum retail prices for Tuberculin Tested Milk have also been prescribed, which range from $2d.$ to $4d.$ per gal. higher than those prescribed for ordinary milk according to areas of population.

Farmhouse Cheese. The Board, after consulting the National Cheese Council, have prescribed a farmhouse cheese contract on the same terms as last year.

Prices for August, 1937. Pool prices and rates of producer-retailers' contributions for August, 1937, are given below, with comparative figures for July, 1937, and August, 1936. In each month the wholesale liquid milk price was $1s. 1d.$ per gallon.

Region	Pool Prices			Producer-Retailers' Contributions		
	August 1937 d.	July 1937 d.	August 1936 d.	August 1937 d.	July 1937 d.	August 1936 d.
Northern	$10\frac{1}{2}$	10	$9\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	3
North-Western	$10\frac{1}{2}$	10	$9\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	3
Eastern ..	$10\frac{3}{4}$	$10\frac{1}{2}$	10	$1\frac{1}{8}$	$2\frac{1}{8}$	$2\frac{1}{8}$
East Midland	$10\frac{1}{2}$	$10\frac{1}{2}$	$9\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	$2\frac{1}{8}$
West Midland	$10\frac{1}{2}$	$9\frac{1}{2}$	$9\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	3
North Wales	$10\frac{1}{2}$	$9\frac{1}{2}$	$9\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	3
South Wales	$10\frac{1}{2}$	10	$9\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	3
Southern ..	$10\frac{3}{4}$	$10\frac{1}{2}$	10	$1\frac{1}{8}$	$2\frac{1}{8}$	$2\frac{1}{8}$
Mid-Western	$10\frac{1}{2}$	$9\frac{1}{2}$	$9\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	3
Far-Western	10	$9\frac{1}{2}$	$9\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	3
South-Eastern	11	$10\frac{1}{2}$	$10\frac{1}{2}$	$1\frac{1}{8}$	2	$2\frac{1}{8}$
Unweighted Average	10.41	10.09	9.70	2.19	2.49	2.85

These prices are exclusive of any premiums for special services and level deliveries, and also of the Accredited producers' premium of $1d.$ per gallon.

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The accredited premium was paid on 29,893,570 gal., and the sum required for the payment of the premium was equivalent to a levy of .344*d.* per gallon on pool sales.

The inter-regional compensation levy was fixed at 1*d.* per gallon, compared with 1½*d.* per gallon in August, 1936.

Sales on wholesale contracts were as follows:—

	<i>August, 1937 (estimated)</i>	<i>August, 1936</i>
	<i>Gal.</i>	<i>Gal.</i>
Liquid	48,688,898	45,820,956
Manufacturing	26,648,343	34,179,538
	<hr/> 75,337,241	<hr/> 80,000,494
Percentage liquid sales	64·63	57·28
Percentage manufacturing sales	35·37	42·72

The average realization price of manufacturing milk during August was 6.29*d.* per gallon compared with 5.26*d.* per gallon for August, 1936. The quantity of milk manufactured into cheese on farms was 2,739,526 gallons compared with 2,995,614 gallons in the previous month and 2,519,131 gallons in August, 1936.

Potato Marketing Scheme. *New Riddle Regulations.* The Board on August 26 made new riddle regulations to operate from that date. The minimum riddle for King Edward and Red King is 1½-in. and for all other varieties 1½-in.; the 2-in. riddle prescribed by the Board on August 5, 1937, for the varieties Kerr's Pink and Red Skin produced in Scotland remained in force until September 6, 1937, after which date these varieties became subject to the minimum riddle of 1½-in. for "all other varieties."

Purchase of Potatoes. With the object of steadying the market, the Board has decided to purchase, anywhere in Great Britain, as may be necessary, potatoes at 50*s.* per ton, or at such higher price up to 60*s.* per ton as may be approved.

Hops Marketing Scheme. The Hops Marketing Board have decided to make, through their agents, an advance of £5 per pocket in respect of sound 1937 quota hops delivered into approved warehouses. This is the same rate of advance as was made last year in respect of 1936 quota hops.

National Mark Cheese Schemes. Following a recommendation of the National Mark Cheese Trade Committee the Minister has made revised regulations amending the definition

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of quality of Lancashire cheese by prescribing that the minimum age of cheese at the time of grading shall be 10 days throughout the year. The regulations—the Agricultural Produce (Grading and Marking) (Lancashire Cheese) Regulations, 1937—supersede the Agricultural Produce (Grading and Marking) (Lancashire Cheese) Regulations, 1936, which provided that the minimum age at the time of grading should be 10 days during the months of June, July and August and 14 days during other months.

The Minister has also given notice of his intention to amend the Agricultural Produce (Grading and Marking) (Leicester Cheese) Regulations, 1936, and the Agricultural Produce (Grading and Marking) (Wensleydale Cheese) Regulations, 1936, respectively, in order to give effect to the recommendations of the Trade Committee that small Leicester cheeses ranging from 16 lb. to 20 lb. in weight and small Wensleydale cheeses of 1 lb. and 2 lb. in weight should be brought within the scope of the National Mark Scheme. The minimum grading age for the small Leicester cheese will be the same as for the larger cheese, i.e., 4 weeks. Under the new Wensleydale regulations cheeses of 1 lb. or 2 lb. in weight may be graded at the age of 5 days, while cheeses over 2 lb. in weight will continue to be gradable at the age of 14 days.

National Mark Publicity. A National Mark "Week" and Exhibition will be held at Taunton during the period October 6-15 with the co-operation of the Civic Authorities. The Ministry will stage appropriate exhibits at the Marden Fruit Show, October 6-7, the North London Exhibition, October 13-20, the Dairy Show, October 19-22, and the Imperial Fruit Show, Birmingham, October 20-28. Arrangements have been made for demonstrations in the testing, grading and packing of National Mark eggs at the North London Exhibition; and demonstrations of the grading and packing of apples will be given at the Imperial Fruit Show, while a special dairy exhibit is to be staged on the Ministry's Stand at the Dairy Show.

Samples of National Mark produce will be on sale at the Taunton National Mark Exhibition and at the North London Exhibition.

A full range of the Ministry's publications will be on sale on each occasion.

OCTOBER ON THE FARM

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Except in late districts harvest is now completed and progress is being made with autumn cultivations. Up to the time of writing, conditions for harvesting have been good in most districts and corn crops have been secured in good condition if somewhat disappointing in yield. The ploughing of stubbles is going on apace in many places, and on several of the stiffer soils the ploughed furrow reveals indifferent physical condition. On the stronger soils in particular there is no doubt that the poor crops were due to lack of good cultural condition. Last spring it was most difficult to obtain satisfactory soil conditions for putting in the seed, and examination of the cornfields after ploughing shows that the variation in crop obtained on different parts of a field coincides with the differing states of the soil.

Potato Crop. During the present month the greater part of the main crop potatoes is lifted. The large grower is as concerned about the weather at this season of the year as is the corn grower at harvest time. Wet weather involves extra labour, poaching of the soil, bad conditions for sowing wheat, and the sample of potatoes is not so good. In many districts early varieties have cropped well, but main crop potatoes were planted late and under poor conditions, and the prospects do not appear so good. In some parts disease has cut down the foliage, resulting in a very short growing season and light yield as well as probable loss from diseased tubers. Even where little disease is to be seen the tops died down quite early in some districts. Last season the state of tubers in the clamp was a matter of concern to the grower throughout the winter, and it seems as if during the coming winter there will be similar worries for many. Frequent examination of the clamp is important. This involves cutting right through, as the outside tubers give no true indication as to the real state of affairs in the bulk.

Much seed will be put into boxes for sprouting and an extension of the practice would result in better returns. In areas where large acreages of ware potatoes are grown the practice of sprouting seed is almost general. In Jersey, Cheshire and Lancashire sprouting is mainly done in farm buildings, while

in the potato-growing district of Lincolnshire large glass-houses are specially built for the purpose. Last spring, which was a late one, the writer saw a remarkable instance of the advantage of sprouting, sprouted tubers planted in June having produced a good crop. Unsprouted seed planted under the same conditions are not likely to produce more than two tons per acre.

Milk Recording. The present month sees the commencement of another recording year. It is one thing to keep records and another to utilize them; too large a proportion of breeders limit themselves to the former.

While recording is of great advantage to the milk producer in showing the daily yields, which supply information with regard to health, feeding, etc., it is in relation to breeding policy that recording is likely to prove of the greatest future value to the dairying industry. The true value of the information obtained needs to be duly assessed before being utilized in connexion with breeding policy.

Until recently breeders followed Bakewell's methods of breeding, which involved the conception of an ideal type of animal, and the mating of animals that together most nearly approached this ideal. This method has been practised with some measure of success, but its chief weakness is the fact that conformation and external appearance do not indicate the hereditary make-up, and consequently the breeding ability of an animal, with any degree of exactness. This fact is realized only too frequently. How often have breeders been disappointed in the results obtained from animals of outstanding character and quality? How frequently do we find animals showing similar external characters producing offspring with markedly different characters?

Selection for type, or purely on the basis of external characters, has often produced disappointment from the breeder's point of view, and, indeed, no great success can be claimed for it on the basis of relating these external characters to performance.

For this reason breeders, particularly breeders of dairy stock, have worked on a performance basis, taking into account milk and butter fat yields. These are factors capable of exact measurement, and the practice of keeping such records of performance is now widely adopted amongst the most up-to-date breeders. Nevertheless, although the milk yield of an animal is capable of exact measurement there are many factors

that come into play in practice and affect the yield, and these must be taken into account by the breeder in assessing the productive ability of any individual animal. Milk yield alone may be most misleading as a basis of assessing the value of an animal both as a yielder and as a breeder of dairy stock.

It has been demonstrated that *feeding* has a most marked effect on the yield, and this factor must always be considered. While all cows in the same herd may be looked upon as having similar treatment as regards feeding, it does sometimes happen that cows with high productive capacity do not have the opportunity to show their ability in this respect, and may be classed with inferior cows. On many farms the maximum yield does not exceed 800 gallons, on account of management, although the herd may include animals capable of giving well over 1,000 gallons, and on such farms there is no possibility of discriminating between 800-gallon and what may be 1,000-gallon cows.

It frequently happens that dairy cows are fed largely on home-produced coarse fodders, which may vary very much from season to season, and the result of this is often reflected in milk yield.

The *season of calving* must also be taken into account. On most farms, particularly on arable farms, or on farms where a careful system of rationing is adopted, autumn- and winter-calving cows will usually be found to give a higher yield than those calving in spring and early summer.

Age is another factor that must be considered, as it is said that as a rule a cow's yield increases up to seven or eight years of age, after which it decreases. The highest yield will usually be obtained with the fifth or sixth calf. It may be generally assumed that under similar conditions of management a first-calf heifer giving 700 gallons would give 800 gallons with her third and 1,000 gallons with her fifth or sixth calf.

The effect of *pregnancy* is usually seen in a falling off in milk yield after the twentieth week. A cow served 85 days after calving should calve on the anniversary of the previous calving date, and this is the standard taken for comparison of official records. Cows served in the first heat period after calving may calve less than 10 months after, and are thus penalized. Sanders suggests that an allowance of 26 per cent. should be added to the actual milk yield under such conditions. Cows allowed a long run before a service have a distinct advantage, and here again Sanders suggests that deductions

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should be made for service periods over the standard 85 days up to 27 per cent. for 360 days.

The *period of rest* before calving also plays an important part in the yield. It is usually recommended that a cow should be dry for six weeks before calving. It would seem that there is little advantage in a rest period of more than eight weeks, but if the rest period is reduced to less than six weeks the yield during the following lactation may be materially decreased.

Another important factor affecting the actual yield of the animal is the conditions under which the animal has been brought to maturity. We know that an animal when born has inherent possibilities, but whether these are realized or not depends to a very great extent on the conditions under which the animal is developed and brought to maturity. Hence it frequently happens that an animal which, owing to conditions of environment and management, shows in itself poor standards of form and performance, may prove a breeder of superior progeny. Our knowledge of heredity helps us to understand these facts, and to realize that, while nurture may seriously affect the development of the inherent characters of an animal, the inheritable characters are already established at birth.

In selecting animals for breeding, therefore, the breeder must be careful to put a correct value on the record figure of any individual animal. When one considers the probable errors involved and the effect of the various factors already mentioned, it will be understood that the errors involved in a more rigid method of measurement such as milk yield alone may be as great, or even greater, than the errors involved in the system of estimating values from type and external characteristics.

It must be borne in mind that the system of judging animals on form and external characters has the advantage that it allows for the assessing and balancing of numerous factors that cannot be measured *in toto*. For this reason it seems desirable that the breeder should not neglect the study of the animal from the point of view of form in relation to performance in selecting for increased production, or attach undue importance to milk yield alone.

There is little doubt that the study of animal type and the relation of body characters to performance, whether it be for milk yield or for flesh production, has been the foundation of our live stock improvement. Performance standards, whether in milk yield or carcass production, as well as pedigree

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records and breeding tests, are valuable assets to the breeder, but only when the principle of selection for type is properly understood.

The risk of disaster in carrying out breeding operations purely on the basis of performance is particularly great unless due attention is paid to type and constitution.

Grazing Cattle. Since the middle of August, in most grazing areas, cattle have made less progress than in normal years. In some instances this is due to shortage of pasture, but even where pasturage is plentiful and appears to be of good quality, cattle are not doing well.

Many of the best graziers of fattening cattle who do not normally need to feed supplementary food have been giving an allowance of concentrates for some time now. Although purchased foods are dear it is sound policy to keep cattle in improving condition.

Turnips, kale and cabbage are useful home-produced supplementary food for some classes of stock where such is needed, but in order to get the best returns it is important to maintain the digestive system in right condition. Undue laxativeness and cold weather do not make for well doing.

It is usually cheaper to maintain condition with livestock than to recover it after it has been lost, and during the present month stock may lose condition if not carefully watched.

Finger-and-Toe Disease. Many complaints of loss from Finger-and-Toe disease in swedes and turnips have been received this season. Where loss has occurred it is desirable that the soil should be tested for acidity, and consideration given to the application of lime to infected land.

On soils where loss is experienced from this disease it is advisable to adopt measures of control before the time of sowing the succeeding cruciferous crop. The success of lime treatment depends upon the lime being thoroughly mixed with the soil, as well as the application of sufficient to neutralize the acidity. The guidance of County Agricultural Staffs should be obtained where necessary both as to quantities required, and as to the most economic form of lime to apply, as it is not sound policy to apply lime for any purpose without knowing the actual requirement. Where Finger-and-Toe has been present in the root crop there is a danger of the barley crop not doing well. Lime applied for the barley would also be advantageous for the succeeding root crop.

NOTES ON MANURING

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The Use of Lime and Basic Slag to Increase Soil Fertility.

(a) *Grass Land.* In last season's notes on manuring frequent mention was made of the importance of lime and phosphate in the routine manuring of much of the land in this country, and in the notes for May, 1937, particular emphasis was placed on the apparent fall in the estimated consumption of phosphoric acid during recent years as compared with the consumption of nitrogen and potash.

The Government's Land Fertility Scheme includes financial assistance for the purchase of lime and basic slag, and provides an opportunity for restoring the soil reserves of these two plant foods at much less expense to the farmer than has been possible for some years. (See pp. 609, 619, 624.)

Frequent reference to the opportunities offered by the Scheme has already been made in the press, but it may be worth while to mention here some of the directions in which a farmer can and should make use of the concessions in the cost of lime and slag. One objective of the Scheme on which considerable emphasis is placed, is the desirability of raising the fertility of our permanent grass land. The reason for this emphasis on grassland improvement is of course twofold: (1) the fact that grass is one of our greatest natural resources and should be utilized to the fullest extent, and (2) good grass land, well managed, constitutes a valuable reservoir of fertility for use in a national emergency. The need for improvement is apparent not only in some of the old established grass land but also in much of the land which, during the recent depression years, went down to grass because it had ceased to be profitable under arable crops. Such land was frequently farmed out, and conditions in the live-stock industry were not sufficiently attractive

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to induce farmers to spend the money necessary to convert it into decent grass.

Good grass land is not only valuable from the standpoint of the health and productivity of the live stock it carries but is continuously accumulating fertility, a fact that is obvious from the crops it produces if and when it is ploughed up.

Poor grass land, on the other hand, cannot be regarded as a reservoir of fertility. Valuable time, money, and fertilizers would be necessary to raise its productivity to the standard necessary for the high level of production that a national emergency might demand. A weak sward, devoid of clovers, and growing on soil deficient in lime or phosphate, can never represent a high level of fertility. It is surprising, however, what an improvement can nowadays be brought about, even in the poorest swards, with the aid of the right fertilizers, suitable cultivations and proper seeds mixtures, where re-seeding is necessary.

There are in this country many thousands of acres of grass land that could be improved in respect of quantity and quality of produce by a suitable dressing of basic slag, possibly in conjunction with some light cultivation such as harrowing. This treatment usually encourages the spread of wild white clover, and, with careful stocking, the sward will then automatically improve. In other instances, on very acid soils, it is a well known fact that basic slag alone is not sufficient, and liming must be carried out before such soils will show a worth-while response to slag. Many of the more valuable herbage species, including such useful and often all-important types as wild white clover and perennial rye grass, will only withstand a certain amount of lime deficiency. At a higher degree of acidity they die out and their place is taken by less desirable and often less palatable species, with consequent development of rough, badly-grazed patches. In such circumstances an initial dressing of lime is essential, and if this is later backed up by an application of basic slag, coupled with suitable mechanical treatment, then the desired improvement will usually follow *in time*.

The fact that improvement of this type of grass land, very deficient in lime as well as phosphate, is frequently slow has, in recent years, often led to the adoption of an alternative method of treatment, namely, ploughing out and then re-seeding after the application of the necessary lime and a good dressing of slag. This latter method usually brings about

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a more rapid improvement, especially if care is taken to re-sow with a suitable seeds mixture.

In the past it was usually considered safest to rely on the improvement of old herbage by the action of lime, fertilizers, etc., even if this meant waiting several years. The rapid increase during recent years in our knowledge of the formation and management of grass land has shown that it is often unnecessary to wait for such slow improvement. The adoption of the more drastic method of ploughing and re-seeding not only accelerates the improvement, but, with the help of modern seeds mixtures and a full realization of *the importance of wild white clover and basic slag* in the laying down of grass land, frequently results in the establishment of a better sward than would ever have been obtained by the older and slower method.

There is still considerable opposition in some quarters to the ploughing up of old grass land, and it is not intended to suggest here that such a practice should be universally adopted. It is a fact, however, that much poor and worn-out grass land could be improved more quickly and more successfully with the help of the plough than by the action of lime and fertilizers alone. This applies both to old matted grass land and to the thin and weedy sward so characteristic of arable land that has been allowed to "tumble down" to grass.

Information as to whether basic slag alone will bring about the desired improvement on any particular field, or whether lime is also necessary, can be obtained through County Agricultural Organizers, who will also advise as to the desirability of ploughing out and re-seeding. In any programme for improvement of a particular piece of grass land the important points to bear in mind are (1) to make quite sure whether both lime and slag are necessary, (2) to give enough lime to satisfy the requirements of the soil, (3) if phosphate is required, as it usually is, to give a heavy initial dressing of basic slag, usually 8 to 10 cwt. per acre, (4) to carry out any mechanical treatment of the turf that is considered likely to assist the action of the lime or slag, (5) to sow a suitable seeds mixture, if ploughing and re-seeding are necessary, and (6) that skilful management and stocking will not only materially assist and accelerate the process of improvement, but will largely determine how long such improvement will be maintained.

One cannot place too much emphasis on the need for ascertaining whether or not lime is necessary, and if so, in what

quantity. To apply lime to land not in need of it is waste of money and effort, but it is equally futile to withhold lime from land that needs lime as well as phosphate. Any farmer who is in doubt on this or any similar point can obtain reliable information based on experience in his own district by applying to his County Agricultural Organizer or local Advisory Centre.

(b) *Arable Land.* The cost of basic slag has been reduced mainly to encourage its extended use on grass land. Some farmers may consider that they have little to gain by substituting basic slag for their usual phosphatic fertilizer on arable land, despite the reduction in the cost of the slag. There are certainly instances where the adoption of such an attitude may be justifiable. There are circumstances in which other types of phosphatic fertilizer may be preferable to slag, and where past experience has shown this to be so it would obviously be wrong to change to a less suitable fertilizer merely because it is cheaper. The best solution of the problem probably lies in giving a little more careful thought and consideration to the actual choice of the phosphatic fertilizer than has been customary in the past, and, wherever possible, basing the final selection on definite experimental evidence as to the comparative merits of the various fertilizers under similar conditions. Farmers who have been using fairly heavy dressings of phosphate, and have, in consequence, built up a substantial reserve of phosphate in their arable soils, may be justified in taking advantage of the reduction in the cost of slag to recover some of their former expenditure by reverting to normal dressings at the reduced cost. There are, however, relatively few farmers in this position compared to the number whose land would probably do rather better if its phosphate reserve could be improved.

In view of the importance of an adequate supply of phosphate to all crops during their seedling stage, and the part it plays in the establishment of a strong and vigorous root system, it is always safer to maintain a good reserve of phosphate in the soil than to rely on the immediate availability of a fertilizer applied at or very near the time of sowing the crop.

On many heavy soils, where phosphate is particularly valuable, basic slag is often as effective as any other source of phosphate, especially if it is applied early in the season. In such instances it is to be hoped that farmers will at least decide

NOTES ON MANURING

to devote as much money to the purchase of phosphatic fertilizer as in past years. In view of the reduction in the cost this would mean that, where slag is used, the land would receive a slightly larger quantity of phosphate per acre. Since any phosphate in the slag that is surplus to the requirements of the first crop will not be washed out, it will automatically serve to raise the phosphate reserves in the soil.

For farmers who intend to apply phosphate for their autumn-sown crops, basic slag is generally a suitable source of phosphate for winter beans and autumn-sown cereals. On most soils about 5 cwt. per acre of a good grade of slag would be a suitable dressing for these crops. On very light soils it is often desirable to obtain local advice as to the relative merits of slag and other types of phosphatic fertilizer.

When one comes to the question of lime there can be no doubt that a very large area of arable land would derive substantial benefit from an application of lime. This applies not only to land that has become so deficient in lime as to cause serious crop failure, but also to those borderline cases in which the farmer, by careful selection of crop and fertilizer, has been able to delay the time when liming must be done to avoid loss of crop.

To prolong such a system of farming is usually unwise. Not only does it restrict to some extent the choice of crop and fertilizer, but on heavy soils shortage of lime frequently leads to difficulties in maintaining the soil in that friable and open condition that is so helpful to root development and the free drainage of surplus water. Several fertilizers do supply small amounts of lime, but when the acidity of a soil has become so pronounced as to cause visible interference with crop growth the time has come to resort to liming.

The concession in the cost of lime and basic slag under the Scheme is intended to be available for at least three years, and as far as possible this should be borne in mind when drawing up a liming programme for any farm. Attention should first be given to fields to be sown with crops such as barley, sugar beet, mangolds, etc., which are intolerant of acidity. Fields to be sown with wheat, oats, potatoes and other crops resistant to acidity can well be left till a later season. In this way the fullest advantage will be taken of the scheme by ensuring that the lime is applied for those crops most in need of it, whilst the cost and labour will be spread over a period of years. Space does not permit of further discussion of the subject, but one

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other point must be emphasized, namely, if the 1938 crops are to derive benefit from lime applied this winter, then the sooner the liming is done the greater will be the response in the 1938 crop.

Finally, the need of a soil for lime is a subject on which advice can usually be given with considerable confidence. Before embarking on any liming programme farmers should first ascertain through their County Agricultural Organizer if their soil is likely to benefit from liming and if so what quantity it requires.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended Sept. 15				
	Bristol	Hull	L'pool	London	Costs per Unit [¶]
Nitrate of Soda (N. 15½%) ..	£ 8 0c	£ 8 0c	£ 8 0c	£ 8 0c	s. 10 4
" " Granulated (N. 16%) ..	8 0c	8 0c	8 0c	8 0c	10 0
Nitro-Chalk (N. 15½%) ..	7 10c	7 10c	7 10c	7 10c	9 9
Sulphate of Ammonia :—					
Neutral (N. 20·6%) ..	7 5c	7 5c	7 5c	7 5c	7 0
Calcium Cyanamide (N. 20·6%) ..	7 7d	7 7d	7 7d	7 7d	7 1
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 0	5 1	4 19	4 17	3 3
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%) ..	8 3	8 8	8 5	8 1	3 3
Sulphate " (Pot. 48%) ..	9 13	10 0	9 17	9 11	4 0
Basic Slag (P.A. 15½%) ..	2 10b	2 2b	—	2 7b	3 0
" " (P.A. 14%) ..	2 5b	1 17b	1 17b	2 3b	3 1
Grd. Rock Phosphate (P. A. 26-27½%) ..	2 17a	—	2 15a	2 12a	2 0
Superphosphate (S P.A. 16%) ..	3 4	—	3 3e	3 0f	3 9
" " (S P.A. 13½%) ..	3 1	2 17	2 19e	2 16f	4 1
Bone Meal (N. 3½%, P.A. 20½%) ..	—	7 5	7 58	7 2	—
Steamed Bone Flour (N. ½%, P.A. 27½-29½%) ..	5 5h	5 10	5 0g	5 0	—

Abbreviations : M. = Nitrogen ;

P.A. = Phosphoric Acid ;

S.P.A. = Soluble Phosphoric Acid ;

Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater, at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 5-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 5 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra, and for lots of 4 cwt. and under 1 ton, 20s. extra.

e Prices shown are f.o.r. Widnes.

f Prices shown are f.o.r. northern rails ; southern rails, 1s. 3d. extra.

g Prices shown are f.o.r. Appley Bridge.

h Price shown is f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertiliser, for example, with 10 per cent. nitrogen, contains 16 such "units" in a ton. Then, if the price per ton of such a fertiliser be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Restricted Rationing of Pigs. In the Notes on Feeding in the February issue of this JOURNAL (Vol. XLIII, p. 1099), attention was drawn to the accumulating evidence of the possibility of securing better economic returns in pig feeding by restricting the daily rations, after the pig has completed its first stage of rapid growth, to a level rather below that reached in the common practice of allowing the pig as much as it will eat in 20-30 minutes at two meals daily.

One disadvantage of the restriction system when applied to groups of pigs is that many pigs are inclined to be restless owing to not feeling "satisfied," whilst those pigs that are least able to maintain their place in the competition at the trough may secure much less than the average amount of food.

If the object of the restriction be viewed as being simply that of reducing the amount of digestible nutrients taken by the pig per day, a way round the foregoing difficulties might perhaps be found by reducing the concentration (or increasing the bulkiness) of the ration and feeding up to appetite as usual. Each pig is then fully satisfied, whilst the rate of growth and fattening is slowed down to the desired extent by the reduced nutritive value of the diet. An experiment along these lines has just been completed at the Harper Adams College, and the results indicate that the solution of the practical problem of restricted rationing of groups of pigs may perhaps be attainable along these lines, although in this particular instance the lowering of the concentration of the ration proved to be excessive and led to economic loss.

In this experiment with two Lots, each of 15 Large White pigs of average initial weight, about 70 lb., Lot I received normal rations containing a moderate proportion of bulky foods, and Lot II received mixtures of the same foods, but containing a much higher proportion of the bulkier ingredients. The general character of the rations is indicated by the following summary:

NOTES ON FEEDING

				<i>Start</i>		<i>Finish</i>	
				<i>Lot I</i>	<i>Lot II</i>	<i>Lot I</i>	<i>Lot II</i>
				(<i>Normal</i>)	(<i>Bulky</i>)	(<i>Normal</i>)	(<i>Bulky</i>)
				%	%	%	%
Cereals	{ Barley 2 }	..	..	53	27	77	57
	{ Maize 1 }	..	..		
Sharps	..	..	..	35	55	20	33
Bran	..	..	..	—	10	—	10
White-fish Meal	..	..	..	12	8	3	—
Minerals	..	..	..	—	1½	1	2

The outstanding difference between the rations may be described as relatively high cereals, low " offals " for Lot I, and low cereals, high " offals " for Lot II. Some adjustment in the proportions of white-fish meal was necessary to equalize the protein supply in the two sets of rations. A similar necessity explains the differences in the use of mineral supplements.

Both Lots were fed twice daily, receiving at each feed as much as they would take. In accordance with expectation, the rate of growth and efficiency of food utilization of Lot II soon fell behind the record of Lot I, and continued thus throughout the experiment. It followed that the pigs of Lot II required much longer to bring up to baconer weight, and by the time all had been marketed the average food consumption per head (and per 1 lb. liveweight gain) was much higher for this Lot than for Lot I. The grading of the carcasses was excellent in each Lot and showed no significant difference between them in this respect, so that a substantially higher financial surplus over food cost was obtained from Lot I than from Lot II.

The main features of the results are summarized in the appended table. The pigs were marketed in three batches, after feeding for 13, 16 and 19 weeks respectively, so that the average period of feeding is expressed in " pig-days."

	<i>Lot I</i>	<i>Lot II</i>
Number of Pigs	14*	15
Average Period of Feeding (" Pig Days ")	115.5 days	125 days
Average Initial Weight	67.5 lb.	67.4 lb.
Average Liveweight Gain	149.8 "	138.6 "
Average Food Eaten	616.6 "	675.0 "
Average Food per 1 lb. Liveweight Gain	4.11 "	4.87 "
Average Carcass Percentage	74.4	71.8
Payment Grades	11A, 2B, 1C	10A, 2B, 1C†
Average Gross Returns per pig	£5 2s. 6d.	£4 13s. 0d.
Average Cost of Food per pig	£2 6s. 3d.	£2 10s. 10d.
Average Surplus over Food Costs per pig	£2 16s. 3d.	£2 2s. 2d.

* One pig removed owing to rupture.

† 2 pigs underweight, not graded.

It will be noted that, despite the longer average period of feeding, the pigs of Lot II were on the whole marketed at

NOTES ON FEEDING

rather lighter weights than those of Lot I, and, moreover, ate on the average about $\frac{1}{2}$ lb. more meal for each pound of live-weight gain, although the record of Lot I in the latter respect was not up to average experience. They also showed a rather greater percentage loss in killing. By itself the experiment proves nothing more than that the feeding of Lot II was less remunerative than that of Lot I; further experiments on the same lines are needed to demonstrate whether the difference was associated with the "bulk factor" or was due to specific inferiority of the rations given to the second Lot.

Protein Requirement of the Laying Hen. The dry substance of the hen's egg is relatively rich in protein, which can only come from the proteins of the food-supply, and consequently it is a matter of obvious importance that the supply of food-protein shall be adequate to sustain the level of egg-production at which the bird is operating. Unless the level of production is already high, an increase of food protein may augment egg-production, but for each level of production there is an optimum protein supply, beyond which further increase of protein becomes uneconomic. Since protein is usually more expensive to supply than carbohydrates, it is clearly desirable, especially in times of high food costs, to have as accurate knowledge as possible of the limits of economic supply of protein.

Until recently it has been customary to recommend for the laying flock of good laying quality a mash consisting roughly of about 40 parts ground cereals, 50 parts milling "offals," and 10 parts "protein concentrate" (fish meal, etc.), to be given with about an equal quantity of grain. Such a ration (mash and grain combined) would contain $13\frac{1}{2}$ -14 per cent. of protein. Evidence from experimental work in recent years has raised a strong presumption, however, that this dietary is unduly rich in protein for the needs of birds that have access to outside runs. In many instances the level of egg production under such conditions has been substantially maintained without the use of any "protein concentrate" in the mash, and there is now a general tendency to advise a reduction of this item from 10 to 5 per cent. In a few instances, however, reduction of the protein supply has been less successful, and since there is an obvious possibility that breed and environmental factors (such as climate, soil and grass supply) may influence the results, it would be premature to generalize upon

NOTES ON FEEDING

the point until it has been tested more thoroughly with different breeds and under a variety of conditions.

On one point field experiments on this subject must always leave an element of doubt, namely, as to whether the good results obtained on the lower protein diet are not achieved to some extent at the expense of the stock of protein in the hen's body substance. This point can only be decided by experiments in which the whole dietary of the hen is controlled, so that an exact record can be obtained on the one hand of the amount of protein consumed by the bird, and on the other hand of the amounts coming away from her in the form of droppings, eggs and cast feathers. The results of an experiment of this kind, carried out by Macdonald at the National Institute of Poultry Husbandry, have recently been reported (*Poultry Science*, Vol. XVI, No. 4, July, 1937), and tend to confirm the adequacy of the lower protein dietary.

In this experiment two Rhode Island Red pullets were kept in separate cages on low protein rations similar to those used in the field experiments, supplemented by a small proportion (10 per cent.) of alfalfa meal, and a little cod-liver oil. Great care was taken to secure as accurately as possible a complete record of the intake and outgo of protein for each bird separately. The birds kept in good health and maintained a very satisfactory level of egg production, 62.8 and 64.8 per cent. respectively.

With bird No. 1 a continuous record was obtained for 28 weeks, during which period she consumed a daily average of 130 grms. (4.58 oz.) of mash and grain, containing 15.8 grms. protein (12.1 per cent.) of the food. Over the whole period she *lost* from her body only 20.3 grms. of protein, or an average of only about 0.1 gram. per day—a negligible quantity.

The other bird was on test for 13 weeks, during which she consumed an average per day of 153 grms. (5.4 oz.) of mash and grain containing 18.3 grms. protein (12.0 per cent. of the food). Over the whole period she showed a body *gain* of 128 grms. protein, or an average of 1.4 grms. per day.

That the general bodily condition of the birds was satisfactorily maintained was shown by small increases in live weight of about 2 oz. each.

It is clear, therefore, that in these two individual cases a dietary containing about 12 per cent. of protein was ample in itself to cover the needs of the birds for maintenance and egg production. Such a dietary ~~can~~ be constituted from a

NOTES ON FEEDING

mash of 35 parts ground cereals and 65 parts milling " offals " (plus a little salt) fed along with about an equal amount of grain. Whether this level of protein supply will also suffice to cover the requirements for fertility and hatchability remains as yet undecided, but it seems probable.

With both birds the protein consumption and the protein " balance " (gain or loss) fluctuated considerably from week to week, the two data being closely correlated. In weeks of good food consumption the bird usually stored a little protein, whilst in weeks of poor consumption the body usually lost a little protein. Storage or loss of body protein did not appear to be correlated with intensity of egg production; in other words, the protein required for the production of the egg can apparently be drawn largely, if not directly, from the food consumed during the period of production. There was also no evidence of any better utilization of the food protein in periods of high egg production than in periods of relatively low production.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
Wheat, British.. ..	£ s. 8 5	£ s. 0 9	£ s. 7 16	72	s. d. 2 2	d. 1·16	% 9·6
Barley, Canadian No. 3							
Western ..	8 8†	0 8	8 0	71	2 3	1·21	6·2
" Argentine ..	7 10‡	0 8	7 2	71	2 0	1·07	6·2
" Persian ..	7 7‡	0 8	6 19	71	1 11	1·03	6·2
" Russian ..	8 0	0 8	7 12	71	2 2	1·16	6·2
Oats, English, white ..	8 13	0 9	8 4	60	2 9	1·47	7·6
" " black and grey ..	8 10	0 9	8 1	60	2 8	1·43	7·6
" Scotch, white ..	9 17	0 9	9 8	60	3 2	1·70	7·6
" " mixed feed	8 10	0 9	8 1	60	2 8	1·43	7·6
" Chilian, white ..	10 10†	0 9	10 1	60	3 4	1·79	7·6
Maize, Argentine ..	6 13	0 7	6 6	78	1 7	0·85	7·6
" South African, No. 2 White Flat	6 10†	0 7	6 3	78	1 7	0·85	7·6
Peas, Japanese.. ..	20 10†	0 15	19 15	69	5 9	3·08	18·1
Milling Offals—							
Bran, British ..	7 7	0 16	6 11	43	3 1	1·65	9·9
" broad.. ..	7 10	0 16	6 14	43	3 1	1·65	10·0
Middlings, fine, imported ..	7 17	0 13	7 4	69	2 1	1·12	12·1
Weatings, † ..	8 0	0 14	7 6	56	2 7	1·38	10·7
" Superfine; ‡	8 10	0 13	7 17	69	2 3	1·21	12·1
Pollards, imported ..	7 2	0 14	6 8	50	2 7	1·38	11·0
Meal, barley ..	8 17	0 8	8 9	71	2 5	1·29	6·2
" " grade II	8 2	0 8	7 14	71	2 2	1·16	6·2
" maize ..	7 7	0 7	7 0	78	1 10	0·98	7·6
" " South African ..	6 7	0 7	6 0	78	1 6	0·80	7·6
" " germ ..	7 0	0 11	6 19	84	1 8	0·89	10·3
" locust bean ..	7 15	0 5	7 10	71	2 1	1·12	3·6
" bean ..	9 5	0 17	8 8	66	2 7	1·38	19·7
" fish ..	15 0	2 5	12 15	59	4 4	2·32	53·0
" Soya bean (extracted)† ..	9 10	1 9	8 1	64	2 6	1·34	38·3
Maize, cooked, flaked ..	7 17	0 7	7 10	84	1 9	0·94	9·2
Linseed cake—							
English, 12% oil ..	10 2	1 1	9 1	74	2 5	1·29	24·6
" 9% " ..	9 10	1 1	8 9	74	2 3	1·21	24·6
" 8% " ..	9 5	1 1	8 4	74	2 3	1·21	24·6
Cottonseed cake—							
English, Egyptian seed, 4½% oil ..	5 17	0 19	4 18	42	2 4	1·25	17·3
Cottonseed cake, Egyptian, 4½% oil ..	5 7	0 19	4 8	42	2 1	1·12	17·3
Cottonseed cake, decorticated, 7% oil	8 5†	1 9	6 16	68	2 0	1·07	34·7
Cottonseed meal, decorticated, 7% oil	7 15†	1 9	6 6	70	1 10	0·98	36·8

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Coconut cake, 10% oil .	7 17†	0 18	6 19	77	1 10	0.98	16.4
Ground nut cake, decorticated, 6.7% oil	9 5*	1 9	7 16	73	2 2	1.16	41.3
Ground nut cake, im- ported decorticated, 6.7% oil	7 17	1 9	6 8	73	1 9	0.94	41.3
Palm-kernel meal, 1.2% oil	7 0	0 13	6 7	71	1 9	0.94	16.5
Feeding treacle . .	5 0	0 8	4 12	51	1 10	0.98	2.7
Brewers' grains, dried ale	6 7	0 11	5 16	48	2 5	1.29	12.5
Brewers' grains, dried porter	6 0	0 11	5 9	48	2 3	1.21	12.5
Dried sugar-beet pulp..	From £5 7s. 6d. to £5 13s. 0d. per ton ex-factory (according to factory)						

* At Bristol.

‡ At Hull.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex-mill or store. The prices were current at the beginning of September, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 1s. per ton as shown above, the cost of food value per ton is £9 19s. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1.43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices :—N., 7s. 4d. ; P₂O₅, 2s. 8d. ; K₂O, 3s. 6d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow:—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6·2	7 16
Maize	78	7·6	6 13
Decorticated ground-nut cake	73	41·3	8 11
„ cotton-seed cake	68	34·7	8 5

(Add 10s. per ton, in each instance, for carriage.)

The cost per unit starch equivalent works out at 1·98 shillings, and per unit protein equivalent 1·01 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent	Protein equivalent	Food Value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	7 12
Oats	60	7·6	6 6
Barley	71	6·2	7 7
Potatoes	18	0·8	1 16
Swedes	7	0·7	0 15
Mangolds	7	0·4	0 14
Beans.. .. .	66	19·7	7 11
Good meadow hay	37	4·6	3 18
Good oat straw	20	0·9	2 1
Good clover hay	38	7·0	4 2
Vetch and oat silage	13	1·6	1 7
Barley straw.. .. .	23	0·7	2 6
Wheat straw.. .. .	13	0·1	1 6
Bean straw	23	1·7	2 7

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d., post free 7d.

MISCELLANEOUS NOTES

The Agricultural Index Number

The August index number of prices of agricultural produce at 133 (base 1911-13=100) is 2 points higher compared with the previous month and 14 points above that of a year ago. If allowance be made for payments under the Wheat Act, 1932, and the Cattle Industry (Emergency Provisions) Act, 1934, the revised index becomes 136. Barley, fat pigs, eggs, butter, cheese and wool were the principal items showing an increase in price while wheat, oats, fat cattle and sheep and potatoes were lower on the month.

Monthly index numbers of prices of Agricultural Produce. Corresponding months of 1911-13 = 100.)

Month	1932	1933	1934	1935	1936	1937
January	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	140
May	115	102	112	111	115	133
June	111	100	110	111	116	131
July	106	101	114	114	117	131
August	105	105	119	113	119	133
September	104	107	119	120	127	—
October	100	107	114	113	125	—
November	101	109	114	113	125	—
December	103	110	113	114	126	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and the Cattle Industry (Emergency Provisions) Act (b).

Month	1932	1933	1934	1935	1936	1937
January	—	111	119	124	125	133
February	—	110	117	122	123	133
March	—	106	112	118	122	134
April	—	109	116	126	128	143
May	—	105	116	117	120	136
June	—	104	114	117	121	134
July	—	104	117	120	121	134
August	108	108	122	120	124	136
September	108	111	125	128	133	—
October	104	112	121	119	129	—
November	105	113	120	119	129	—
December	107	114	120	120	130	—

(a) Commenced August, 1932. (b) Commenced September, 1934.

MISCELLANEOUS NOTES

In the following table the monthly index numbers of prices of individual commodities are shown for the months of May to August, 1937, August, 1936, and August, 1935; base, the corresponding months of 1911-13 = 100.

Commodity	1937				1936	1935
	Aug.	July	June	May	Aug.	Aug.
Wheat	118	120	123	124	96	60
Barley	147	127	129	133	100	103
Oats	125	121	120	119	98	92
Fat cattle	119	114	111	112	102	92
„ sheep	141	145	152	160	128	114
Bacon pigs	120	117	114	118	111	98
Pork „	119	115	113	116	107	97
Eggs	138	144	129	112	130	133
Poultry	132	130	132	122	113	115
Milk	175	175	162	162	175	175
Butter	110	112	109	106	100	92
Cheese	126	128	122	112	113	85
Potatoes	127	142	189	196	109	137
Hay	97	95	98	100	98	101
Wool	147	143	138	141	95	89
Dairy cows	114	115	115	112	103	102
Store cattle	119	120	117	115	101	89
„ sheep	142	139	132	133	126	111
„ pigs	141	133	127	125	133	118

Revised index numbers due to payments under the Wheat Act and the Cattle Industry (Emergency Provisions) Act.

Wheat	124	123	125	125	124*	114
Fat cattle	134	128	125	126	117	107
General Index	136	134	134	136	124	120

* Superseding figure previously published.

Grain. Wheat, at an average of 9s. 5d. per cwt., was 3d. lower on the month and the index declines by 2 points to 118.

(If the "deficiency payment" under the Wheat Act, 1932, is taken into account, the figure becomes 124.) Barley rose by 1s. 8d. to an average of 11s. 2d. per cwt. and the index consequently appreciates by 20 points. A fall of 6d. to 8s. 9d. per cwt. was recorded in the price of oats but, owing to a heavier reduction having occurred in the base years, the index rises by 4 points. A year ago wheat averaged 7s. 8d., barley 7s. 7d., and oats 6s. 10d. per cwt.

Live Stock. Fat cattle prices were again slightly lower, the average of 40s. 3d. per live cwt. for second quality showing a reduction of 5d.; the fall during the base months, however,

MISCELLANEOUS NOTES

was more pronounced and the index rises by 5 points to 119. The addition of the subsidy under the Cattle Industry (Emergency Provisions) Act, 1934, brings the index to 134. At 10½d. per lb. for second quality, fat sheep were lower in price by ½d. per lb. and the index moves downwards by 4 points. Quotations and indices advanced for both baconers and porkers, the former averaging 12s. 4d. and porkers 12s. 7d. per score (20 lb.) for second quality, the relative indices being higher by 3 and 4 points respectively.

Compared with July, dairy cows were slightly dearer but, as the rise in the base period was greater, the index falls by 1 point. Store cattle were cheaper during the month under review and the index is lower by one point. Store sheep were unchanged in price but the index advances by 3 points owing to the reduction which took place during the corresponding months of 1911-13. Store pigs at 32s. 3d. per head averaged 1s. 11d. more than last month and the index shows an increase of 8 points.

Dairy and Poultry Produce. The regional contract price of liquid milk was unchanged on the month and the index remains at 175. At 1s. 2½d. per lb. butter averaged ¾d. per lb. more than in July, but, with a greater rise in the base period, the index falls by 2 points. The upward movement in egg prices continued during August, second quality averaging 15s. 2d. per 120 compared with 14s. 2d. a month earlier. The increase, however, was not so pronounced as during the base months and the index declines by 6 points. Cheese, at £4 6s. 6d. per cwt., although slightly increased in price, advanced more during the base period and, as a consequence, the current index at 126 is 2 points lower on the month. The combined index for poultry rises by 2 points.

Other Commodities. First early potatoes, prices of which are used in compiling the potato index during July and August, showed a considerable fall, the average of £5 2s. 6d. per ton being £2 16s. lower. This is reflected in a drop of 15 points in the index to 127 and compares with 109 a year ago. Clover hay was unaltered in price at £4 16s. per ton but, in consequence of a fall in the base price, the index is 6 points higher. At £3 4s. per ton quotations for meadow hay were slightly reduced and the index is lower by 1 point. The combined index for hay appreciates by 2 points. At 1s. 7½d. per lb. wool showed a rise of ½d. per lb. and the index moves upwards by 4 points.

MISCELLANEOUS NOTES

Advisory Leaflets

Since the date of the list published in the August, 1937, issue of this Journal (p. 494), the undermentioned Advisory Leaflets have been issued by the Ministry :—

- No. 214 —Lamb Dysentery (Revised).
- „ 281.—Fowl Pest.
- „ 284 —The Potato Root Eelworm.
- „ 285 —Meadow Saffron.
- „ 286.—The Chrysanthemum Midge.
- „ 287.—Weed Seeds in Grasses and Clovers Harvested for Seed in Great Britain

Copies of any of the above-mentioned leaflets may be purchased from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or at the Sale Offices of that Department at Edinburgh, Manchester, Cardiff, and Belfast, price 1*d.* each net (1½*d.* post free), or 9*d.* net per doz. (10*d.* post free).

Single copies of not more than 20 leaflets may, however, be obtained, free of charge, on application to the Ministry. Further copies beyond this limit must be purchased from H.M. Stationery Office, as above.

A list of the Ministry's publications, including leaflets, on agriculture and horticulture may be obtained free and post free on application to the Ministry.

Scholarships for the Sons and Daughters of Agricultural Workmen and Others

The selection of candidates for this year's awards under the Ministry's scheme of scholarships for the sons and daughters of agricultural workmen and others has been made. The total number of applications received was 587, and 134 scholarships have been awarded. These awards were allocated as follows: 10 Senior Scholarships tenable at University Departments of Agriculture or Agricultural Colleges for Degree or Diploma Courses in an agricultural subject; 10 Extended Junior Scholarships of one year in duration for advanced or specialized courses of instruction at Farm Institutes or Agricultural Colleges; and 114 Junior Scholarships tenable at Farm Institutes and similar institutions for courses not exceeding one year in Agriculture, Horticulture, Dairying or Poultry

MISCELLANEOUS NOTES

Husbandry, or in a combination of two of these subjects.
The following obtained Senior Scholarships:

DEGREE COURSES:

MELVILLE R. DEWINGS	Reading University.
(Northamptonshire Institute of Agriculture)	
BERYL JONES	University College of
(Neath County School for Girls)	Wales, Aberystwyth.
EVAN J. JONES (University College of Wales) ..	University College of
	Wales, Aberystwyth.
MAIR ROBERTS (Madryn Castle Farm School) ..	Reading University.
DORIS M. SPURGEON	Horticultural College,
(Blyth Secondary School, Norwich)	Swanley.
ANEURYN LLOYD WILLIAMS	School of Veterinary
(Denbighshire Farm Institute, Llysfas)	Science, Liverpool
	University.

DIPLOMA COURSES:

RONALD O. BOON	Seale-Hayne Agricul-
(Seale-Hayne Agricultural College)	tural College.
EVELYN A. GRANT	Harper Adams Agricul-
(Northamptonshire Institute of Agriculture)	tural College, New-
	port, Salop.
EDWARD J. LOVELL	Seale - Hayne Agricul-
(Seale-Hayne Agricultural College)	tural College.
ROSCOE E. RILEY (Somerset Farm Institute) ..	Reading University.

United Dairies' Scholarships, 1937-38

The United Dairies' Scholarships awarded for the year 1937-38, the colleges at which they are tenable, and the names of the successful candidates (with the schools at which they were educated) have been announced as follows:—

<i>Name and Address</i>	<i>School</i>	<i>Award</i>
Douglas John Curtis, Blandford, Dorset.	Bishop Word- worth's School.	1 year Agriculture and Dairying, tenable at Sparsholt Farm Insti- tute.
Ruby Sylvia Mary Pearcey, Kennford, Nr. Exeter.	Bishop Blackall School, Exeter.	1 year Dairying, tenable at Somerset Farm Insti- tute, Cannington.
Geoffrey Howard Withers, Portis- head, Somerset.	Bristol Grammar School.	1 year Agriculture, tenable at Somerset Farm Insti- tute, Cannington.
Monica Joyce Brunt, Cerne Abbas, Dorset.	St. Gildas Con- vent, Yeovil.	1 year Dairying, tenable at Somerset Farm Insti- tute, Cannington.
Arthur Myrus Toms, Bude, Cornwall.	County Secondary School, Bude.	3 years B.Sc. Agric. Course, tenable at The Uni- versity, Reading.
Cynthia Mary Pratt, S. Brent, Devon.	County School for Girls, Totnes.	3 years B.Sc. Dairying Course, tenable at The University, Reading.

These scholarships, which are awarded annually, are provided from the Fund created, in 1924, by United Dairies,

MISCELLANEOUS NOTES

Ltd., for the purpose of promoting and encouraging practical and scientific education in dairying and dairy farming. They are available for the sons and daughters of farmers and smallholders in the counties of Cornwall, Devon, Dorset and Somerset, and are tenable at various agricultural centres of education.

A New Method of Harvesting Roots

It is regretted that, owing to an oversight, the article that appeared under the above title in the September issue of the JOURNAL (pp. 519-523) omitted all reference to its author, Mr. J. St. Bodfan-Griffith.

The illustrations accompanying the article were reproduced by courtesy of Jordbrukstekniska Foreningen, Uppsala, Sweden.

Agricultural Returns of England and Wales, 1937

ACREAGE OF HOPS

PRELIMINARY STATEMENT COMPILED FROM THE RETURNS COLLECTED ON JUNE 4, 1937, SHOWING THE ACREAGE UNDER HOPS IN EACH COUNTY OF ENGLAND IN WHICH HOPS WERE GROWN, WITH A COMPARATIVE STATEMENT FOR THE YEARS 1936 AND 1935.

Counties, &c.					1937	1936	1935
KENT	East	..	..	..	1,880	1,990	2,051
	Mid	..	..	..	3,090	3,032	2,969
	Weald	..	..	..	4,950	5,084	5,122
	TOTAL, Kent	..	..	..	9,920	10,106	10,142
HANTS	..	..	..	..	530	556	573
HEREFORD	..	..	..	..	4,050	3,994	3,998
SURREY	..	..	..	..	110	115	110
SUSSEX	..	..	..	..	1,570	1,586	1,462
WORCESTER	..	..	..	..	1,820	1,894	1,901
OTHER COUNTIES	..	..	..	..	70	66	65
TOTAL	..	..	..	..	18,070	18,317*	18,251*

* These figures include the acreage left unpicked, which was estimated in 1936 to be about 1,122 acres and in 1935 about 632 acres.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND.

Wilts : Mr. A. F. Johnson, N.D.A., N.D.D., has been appointed Assistant Instructor in Dairying *vice* Mr. J. R. Keyworth, N.D.A., resigned.
Herts : Mr. C. T. Riley, N.D.P., has been appointed Assistant Instructor in Poultry Keeping. This is a new post.

SAMPLING OBSERVATIONS ON WHEAT 1936-7:

Report for Third and Fourth Quarters

The sampling observations for the third quarter cover the period from tillering date until ear emergence and are summarized in Tables I and II. The mean values during the period 1932-6 are also given for the more important entries and show how the crop compares in condition and rate of growth with past years. Unfortunately the observations at Carlisle have been discontinued, as the observer left and no substitute was available.

Maximum shoot densities were reached somewhat earlier this year than usual, except at Seale-Hayne and for the very backward crop of Yeoman at Newport, while the actual values attained are lower than usual at most stations. It has been found in past years, however, that the values of the maxima have relatively little influence on the final progress of the crop, as the shoot numbers even out considerably towards ear emergence. Yeoman tillered very freely at Newport and Plumpton; at tillering date, the plant numbers were unusually low—198 and 367 respectively—and to make good the deficiency the crops produced an average of over 6 shoots per plant.

Six stations took sufficient observations on shoot height to determine the maximum growth rates. The dates differ by only a few days from the average and are generally somewhat earlier. The actual growth rates are much the same as usual and represent an increase of about 2 cm. per day.

The remarkable regularity from year to year of the dates of ear emergence has been one of the most striking results of the observations. The range this year is from June 16 at Seale-Hayne to July 5 at Boghall, as compared with the average range from June 14 to July 3 (at the same stations). The individual stations show considerable divergences from the average of the past few years both in the density and in the height of the crop, but no consistent deviation in one direction can be noticed.

Varietal differences are well marked at this stage. Square-head's Master is some 12 cm. taller than Yeoman, not so dense a crop and slightly ahead in progress.

The yields of grain and straw, summarized in Table III, show that the year has been a poor one for wheat. For the five stations for which a full set of reliable observations is available, the mean yields of undressed grain of the two

SAMPLING OBSERVATIONS ON WHEAT 1936-7

TABLE I.

Station	Variety	Maximum shoot density				Shoot height	Maximum growth rate				Shoot Density	Shoot Height
		Date		Shoot density			Date		Rate			
		1936-7	Average 1935-6	1936-7	Average 1935-6		1936-7	Average 1935-6	1936-7	Average 1935-6		
Begbail, Edinburgh	S.H.M.† Yeoman	April 26-32 April 30-09	May 2 May 5	3,331 3,610	4,009 4,464	— —	June 13-24 June 13-17	June 16 June 17	2.43 2.23	2.32 1.94	1,963 2,253	47.9 40.6
Cirencester .. Gloucestershire	S.H.M. Yeoman Little Joss	April 27-56 April 26-40 April 24-92	April 30* April 31* —	2,320 3,194 2,940	4,066* 5,394* —	— — —	— — —	— — —	— — —	— — —	— — —	— — —
Rothamsted Hertfordshire	S.H.M. Yeoman Victor	March 28-19 March 24-94 March 27-12	April 13 April 16 April 15	3,246 4,202 3,135	4,470 5,487 4,099	— — —	June 8-02 June 9-50 June 10-54	June 6 June 7 June 7	1.72 1.40 1.55	2.29 2.02 2.15	1,557 1,754 1,641	38.1 28.2 38.5
Woburn .. Bedfordshire	S.H.M. Yeoman	March 28-02 April 3-80	April 15 April 20	3,572 4,422	3,866 4,157	1.01 —	May 31-40 June 2-68	— —	2.63 2.05	— —	2,015 2,496	48.9 41.6
Newport .. Shropshire	S.H.M. Yeoman	May 10-45 June 4-55	May 17** May 17**	1,541 1,212	2,593** 2,702**	— 33.96	— —	June 9 June 9	— —	2.75 2.53	— —	— —
Wye, Kent	S.H.M. Yeoman	April 4-21 April 7-81	April 22 April 26	— —	3,348 3,703	1.75 1.65	June 1-49 June 3-33	June 8* June 9*	2.48 1.90	2.53* 2.05*	2,203 2,462	44.8 38.8
Plumpton, Sussex	S.H.M. Yeoman	April 22-54 April 27-35	April 28* April 30*	2,067 2,256	2,678* 3,428*	6.72 5.20	June 11-01 June 5-14	June 8* June 14*	2.46 2.24	2.45* 2.68*	1,078 1,262	81.1 47.9
Newton Abbot (Seale-Hayne Coll) Devonshire	S.H.M. Yeoman No. 60	April 7-33 April 9-20 April 6-55	March 26 March 25 —	4,139 4,519 —	4,240 5,092 —	— — —	— — —	— — —	— — —	— — —	— — —	— — —
Sproston .. Norfolk	S.H.M. Yeoman	April 15-03 April 19-40	April 17 April 21	4,432 4,901	3,399 4,165	— 1.73	June 4-92 June 5-96	June 8 June 10	2.41 1.95	2.52 2.07	2,369 2,547	40.5 35.1

† Squarthead's Master.

** Omitting 1934-5.

* 1934-6.

SAMPLING OBSERVATIONS ON WHEAT 1936-7

TABLE II.

Station	Variety	Far Emergence						Shoot Height	
		Date		Rate 1936-7	Shoot Density		Average 1933-6	1936-7	Average 1933-6
		1936-7	Average 1933-6						
Boghall, Edinburgh	S.H.M.† Yeoman ..	July 3.02 July 5.27	July 2 July 3	9.1 12.2	1,795 2,141	1,793 2,028	76.15 67.88	84.29 75.35	—
Cirencester, Gloucestershire ..	S.H.M. Yeoman .. Little Joss ..	June 17.76 June 20.84 June 19.98	— — —	8.7 11.9 11.3	1,824 1,877 1,799	— — —	— — —	— — —	—
Rothamsted, Hertfordshire ..	S.H.M. Yeoman .. Victor ..	June 27.74 June 27.09 June 28.32	June 21 June 22 June 22	9.4 9.9 10.7	1,457 1,640 1,478	1,757 2,016 1,782	80.67 68.02 75.62	57.67 47.29 55.07	—
Woburn, Bedfordshire	S.H.M. Yeoman ..	June 17.61 June 19.36	June 22† June 24†	9.9 11.6	1,800 2,302	— —	— —	83.20 69.61	—
Newport, Shropshire	S.H.M. Yeoman ..	June 25.66 July 2.11	June 22 June 24	10.7 5.5	1,096 849	1,559 1,707	90.21 78.35	94.86 77.10	—
Wye, Kent	S.H.M. Yeoman ..	June 17.08 June 17.13	June 20 June 21	9.7 11.2	1,792 2,212	1,893 1,936	73.89* 64.35*	74.58 61.27	—
Plumpton, Sussex	S.H.M. Yeoman ..	June 14.24 June 16.47	June 22* June 23*	12.0 11.8	1,136 1,081	1,390* 1,020*	76.50* 64.22*	84.94 73.64	—
Newton Abbot (Seale-Hayne Coll.), Devonshire	S.H.M.† Yeoman .. No. 60 ..	June 15.66 June 16.73 —	June 15 June 14† —	10.9 10.5 —	1,782 2,212 —	1,764 1,983† —	71.46 — —	71.46 56.74 —	—
Sprowston, Norfolk	S.H.M. Yeoman ..	June 18.51 June 21.74	June 22 June 24	8.7 6.5	1,920 1,941	1,572 1,773	72.94 60.25	67.91 60.08	—

* 1934-6.

† Squarehead's Master.

‡ 1933-35.

SAMPLING OBSERVATIONS ON WHEAT 1935-7

TABLE III.

Station	Variety	Last observations			Date fit for cutting	Date of Harvest.		Yields cwt. per acre			
		Date	Ear Density per 32m.	Ear height c.m.		1936-7	Average 1933-6	Grain		Straw	
								1936-7	Average 1933-6	1936-7	Average 1933-6
Boghall, Edinburgh	S.H.M.* Yeoman	Aug 4 Aug. 4	1,825 2,201	123.2 111.1	Sept. 3 Sept. 3	Aug. 30† Sept. 1†	32.1† 34.4†	31.1 32.2	68.4† 82.2†	55.6 57.1	
Cirencester, Gloucestershire	S.H.M. Yeoman Little Joss	July 30 July 30 July 30	1,689 1,827 1,669	119.9 105.0 124.2	— — —	Aug. 8† Aug. 8† —	32.2 27.5 35.7	— — —	44.8 44.8 46.9	— — —	
Rothamsted, Hertfordshire	S.H.M. Yeoman Victor	Aug. 12 Aug. 12 Aug. 12	1,071 1,229 1,200	84.3 79.9 81.5	Aug. 11 Aug. 12 Aug. 12	Aug. 5 Aug. 5 Aug. 5	10.0† 9.8† 12.8†	29.0 31.5 33.0	20.7 22.1 23.4	54.7 55.1 56.5	
Woburn, Bedfordshire	S.H.M. Yeoman	July 24 July 24	1,787 2,019	120.0 107.0	July 30 July 31	Aug. 2 Aug. 2	20.7 20.7	22.4 25.9	53.6 40.6	51.5 48.9	
Newport, Shropshire	S.H.M. Yeoman	Aug. 18 Aug. 18	1,019 725	— —	Aug. 16 Aug. 19	Aug. 14 Aug. 14	10.3 14.6	37.4 37.4	80.0 48.2	61.5 63.7	
Wye, Kent	S.H.M. Yeoman	July 31 July 31	2,082 2,251	107.0 96.4	— —	Aug. 6† Aug. 6†	15.9 22.1	21.4 26.8	47.5 42.8	50.1 47.1	
Phampton, Sussex	S.H.M. Yeoman	July 29 July 29	1,096 1,150	111.2 101.0	July 29 Aug. 2	Aug. 8† Aug. 8†	25.1 25.0	35.0† 34.9†	22.1 20.6	44.1† 46.8†	
Newton Abbot (Seale-Hayne Coll.) Devonshire	S.H.M. Yeoman Gartons No. 60	July 29 July 29 July 29	1,784 2,100 1,547	110.7 93.1 105.1	Aug. 2 Aug. 3 Aug. 2	July 30 July 31 —	24.6 18.9 23.7	26.7 24.6 —	41.0 30.3 32.8	46.2 41.6 —	
Sproston, Norfolk	S.H.M. Yeoman	Aug. 6 Aug. 6	1,825 1,736	101.1 93.7	Aug. 9 Aug. 11	Aug. 12 Aug. 12	23.3 19.1	25.0 22.7	35.4 31.7	35.2 34.0	
Carlisle, Cumberland	S.H.M. Yeoman Wilhelmina.	— — —	— — —	— — —	— — —	— — —	— — —	— — —	— — —	— — —	

* Squarehead's Master.

† 1934-6.

‡ Lodging.

§ Received too late for discussion in text.

SAMPLING OBSERVATIONS ON WHEAT 1936-7

standard varieties during the past five years are (in cwt. per acre).

1932-3	1933-4	1934-5	1935-6	1936-7
27.0	34.3	33.7	26.2	18.1

This indicates that the present year is distinctly the worst of the set. The figure of 18.1 cwt. per acre is perhaps unduly low, as it contains two unusually poor yields, at Rothamsted, where the crop suffered from waterlogging of the soil in early spring, and at Newport, where the site chosen was a poor one. Of the remaining stations, however, Woburn and Wye both give yields below the average of the past five years, while Cirencester, with the highest yield of all stations this year, is just on the average. The past winter and spring were exceptionally wet in all parts of England and poor yields were anticipated generally. A spell of fine sunny weather during August enabled the crops to ripen quickly and harvesting took place, under excellent conditions, about the same time as usual. As a result, more optimistic opinions about the yields prevailed in many quarters, but the yields show that the crops have by no means fully recovered from the unsuitable conditions in the earlier stages. A good deal of loose smut was reported by the observers, but the actual reduction in yield due to this does not appear to have been serious.

The prediction formula, based on the shoot height at ear emergence and the plant number at tillering, has been re-calculated to include 1935-6 and the earlier results of 1936-7. The results are of sufficient interest to justify a provisional report. In the previous formula, no relation was found between yield and ear number. This result, at first sight rather surprising, means that in the first three years ear numbers were in all instances reasonably high, so that the gain due to an increase in ear numbers was offset by a decrease in weight of ears due to competition effects. With the inclusion of extra material, the ear number is now of importance and the formula reads

Yield = $28.5 + 0.034(h - 712) - 0.0060(p - 1,250) + 0.0073(e - 1713)$
 where h = shoot height, p = plant number, e = ear number.

If ear number alone decided the size of the crop, the factor for ear number in the formula would be $28.5 \div 1713 = 0.0166$ instead of 0.0073, so that a 10 per cent increase in ear number only increases the yield by about 4 per cent.

The observed and predicted yields are shown in Table IV. The predicted yields have been adjusted as if calculated from the first four years only, and give a genuine prediction of the present year's yields. It will be seen that the predictions are all too high this year and indicate an average yield of 26 cwt., instead of 19 cwt. for the five stations included in the formula. It seems reasonable to search for the cause of this discrepancy in the exceptional weather of the past winter and spring, and we may hope that we now have a sufficient variety of seasons so that meteorological

SAMPLING OBSERVATIONS ON WHEAT 1936-7

effects will begin to show themselves. As regards rainfall, this hope is strengthened by the fact that in 1934, which was an unusually dry year, the observed yields were consistently up on the predicted yields. A full examination is being undertaken.

The dry matter observations at Newport and Rothamsted are summarized in Table V. At Rothamsted there has been a drop in total produce between the last dry matter observations and harvest, which may be partly due to lodging. The remarkably high yield of straw for Squarehead's Master at Newport is partly supported by the dry matter figures. The crop was, however, very weedy. The importance of dry matter observations is that they take into account *weights*, which are only indirectly estimated by the other observations. The results, both in this and previous years, show that dry matter does not necessarily increase steadily towards harvest.

TABLE IV.—OBSERVED AND PREDICTED YIELDS

Station	1933		1934		1935		1936		1937	
	Obs.	Pred.	Obs.	Pred.	Obs.	Pred.	Obs.	Pred.	Obs.	Pred.
Newton Abbot (Seale-Hayne Coll.) ..	21	27	32	26	26	28	23	26	22	26
Rothamsted ..	22	26	32	29	35	35	32	29	10	18
Newport ..	35	36	44	40	40	35	32	38	12	—
Boghall ..	33	34	36	34	30	28	28	20	33*	32*
Sprowston ..	25	31	28	28	21	24	21	27	21	24
Plumpton ..	—	—	35	26	47	40	23	28	25	33
Wye ..	11	—	48	43	15	26	21	21	19	30
Mean ..	27	31	36	32	31	31	26	27	19	26
Long Sutton ..	28	29	—	—	11	—	27	—	—	—
Woburn ..	—	—	—	—	19	—	21	26	21	31
Cirencester ..	—	—	—	—	—	—	24	25	30	—

* Received too late for discussion in text.

TABLE V.—DRY MATTER OBSERVATIONS

Station and Variety	Dry Matter		Dry Matter		Yield cwt. per acre	
	cwt. per acre	Per cent	cwt. per acre	Per cent	Grain	Straw
Newport	July 14		July 28		Aug. 19	
S.H.M.* ..	72·6	38·7	74·2	45·6	10·3	80·0
Yeoman ..	44·9	35·1	57·2	42·1	14·6	48·2
Rothamsted	July 12		July 26		Aug. 12	
S.H.M. ..	39·5	41·4	39·9	49·5	10·0	20·7
Yeoman ..	36·1	42·1	38·6	52·2	9·8	22·1
Victor ..	42·4	41·2	45·8	47·2	12·8	23·4

* Squarehead's Master.

MINIMUM RATES OF WAGES

Enforcement of Minimum Rates of Wages. During the month ending September 12, 1937, legal proceedings were taken against thirteen employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow :—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers Involved
		£ s. d.	£ s. d.	£ s. d.	
Cornwall ..	Trigg ..	5 0 0	2 2 0	30 0 0	1
Derbyshire	New Mills ..	0 5 0	0 4 0	1 13 0	1
Durham ..	Gateshead ..	4 0 0	—	31 7 9	1
Lancashire	Garstang ..	(A)	0 5 0	18 0 0	1
"	Wigan ..	5 0 0	—	60 15 0	2
Notts ..	Bingham ..	5 5 0	1 16 6	50 12 7	4
Shropshire	Wellington ..	(A)	0 8 0	10 0 0	1
Wiltshire..	Tisbury ..	2 0 0	—	24 2 0	1
Worcs. ..	Droitwich ..	5 0 0	4 17 0	20 0 0	2
Yorks(W.R.)	Bradford ..	(P)	—	—	1
Breconshire	Talgarth ..	(A)	2 18 0	32 12 0	2
Cardigan	Tregaron ..	2 0 0	—	10 0 0	1
Glamorgan	Merthyr Tydfil	2 0 0	—	7 3 6	1
		30 10 0	12 10 6	296 5 10	19

(A) Dismissed under " Probation of Offenders " Act. (B) Dismissed.

NOTE.—In the case taken at Droitwich, proceedings were also instituted under Section 9 (3) (b) (Refusing to produce documents), but a separate penalty was not imposed.

Foot-and-Mouth Disease. A further outbreak of Foot-and-Mouth Disease was confirmed on August 15 at Hawarden, in the existing Flintshire Infected Area, making a total of 9 outbreaks confirmed in this area subsequent to the initial outbreak at Broughton, Flintshire, on July 24. No further outbreaks were confirmed after August 15 and the Area was consequently contracted on August 29 to approximately 5 miles round Hawarden, and was finally released from restrictions on September 6.

An outbreak was also confirmed at Marske, Richmond, Yorks, on September 12, and, in consequence, restrictions of the usual kind were imposed over an area of approximately 15 miles radius round the farm on which the disease was discovered. This area covers parts of the North Riding of Yorkshire and of the County of Durham.

The area of restriction will be contracted on September 27 to one of approximately 5 miles radius round the Infected Premises.

WIRELESS TALKS, OCTOBER, 1937

AGRICULTURAL

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National :			
Oct. 6	6.20	Mr. W. S. Mansfield	Farming To-day :— Introduction: Autumn Cleaning.
„ 13	6.20	„ „	Autumn Sowing.
„ 20	6.20	„ „	The Dairy Show (with Mr. Allday).
„ 27	6.20	„ „	Harvesting Root Crops.
North :			
Oct. 1	9.0	Mr. W. B. Mercer	Survey of Farming in the North-West
„ 15	6.40	Mr. J. A. Hanley	Survey of Farming in the Four Northern Counties.
„ 29	—	Mr. J. Strachan	Survey of Farming in the East.
Midland :			
Oct. 7	6.40	Mr. W. B. Thompson	For Midland Farmers.
West :			
Oct. 7	6.40	—	For Young Farmers' Clubs.
„ 13	9.0	—	A Commentary on the Tavi-stock Goose Fair.
„ 14	8.15	—	For Western Farmers in particular.
„ 21	6.30	—	For Young Farmers' Clubs.
Welsh :			
Oct. 8	7.30	Mr. E. V. Merchant	The Government's White Paper: Milk Marketing Board.
Northern Ireland :*			
Oct. 1	8.0	Rt. Hon Sir Basil Brooke, C B E., Minister of Agriculture	The Future of Ulster Agriculture.
„ 8	7.30	Prof. S. P. Mercer	For Ulster Farmers: Winter Green: A Talk on Grasses.
„ 15	7.30	Mr. P. Fitzpatrick	Farmers' Work and Worry.
„ 22	9.0	—	Discussion on the Lime and Basic Slag Scheme, between representatives of the Northern Ireland Ministry of Agriculture and the Ulster Farmers' Union.

* A conference on Agriculture is being held by the B.B.C. in Northern Ireland in October, under the chairmanship of the Northern Ireland Minister of Agriculture, the Rt. Hon. Sir Basil Brooke, Bart., M.P. It is hoped that valuable information about agricultural talks and discussions on which future programme policy may be framed, will emerge from the conference. A special pamphlet giving full details about the conference can be obtained free, on application to the Public Relations Officer, B.B.C., 31 Linenhall Street, Belfast. The conference date will be either October 15 or 22.

SELECTED CONTENTS OF PERIODICALS

HORTICULTURAL

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National : Oct. 3	2.0	Mr. C. H. Middleton	In Your Garden :— The Autumn Show (with Col. Durham).
„ 10	2.0	„ „	Vegetables.
„ 17	2.0	„ „	Fruit Varieties.
„ 24	2.0	„ „	—
„ 31	2.0	„ „	Rock Gardens (with Mr. C. Elliott).
North : Oct. 8	6.40	Mr. W. E. Shewell-Cooper and Mr. R. Walthew	Planning a Garden.
„ 22	6.40	Mr. W. E. Shewell-Cooper and Mr. C. Bellis	Strawberries.
West : Oct. 8	7.30	Mr. D. Harris	For Western Gardeners : The Beginner.
„ 22	6.45	Mr. D. Harris and Mr. T. H. Harraway	For Western Gardeners : Roses.
Welsh : Oct. 15	8.0	Mr. T. Jones	Picking and Storing Fruit and Vegetables.
„ 28	7.30	„ „	Planting Bulbs and Flowers.
Northern Ireland : Oct 23	8.45	Mr. H. G. Fleet	An Ulster Garden : Autumn Gardening.

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Agricultural Economics

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Machine versus Horse. *J. Wyllie.* (Inc. Auct. J. 11, 127 (July, 1937), pp. 422-455.)

Investigations on Machinery Used in Spraying, Part IV : Nozzles. *C. Davies and G. R. B. Smyth-Homerwood.* (J. S. E. Agric. Coll., Wye 40 (July, 1937), pp. 50-57.)

Studies on the Relation Between Cultivation Implements, Soil Structure, and the Crop. III. Rolls : An Account of Methods Employed and Study of their Actions on the Soil. *C. Culpin.* (J. Agric. Sci. 27, 3 (July, 1937), pp. 432-446.)

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Botany and Plant Physiology

- Investigations on the Root Nodule Bacteria of Leguminous Plants. XIX. Influence of Various Factors on the Excretion of Nitrogenous Compounds from the Nodule. *A. J. Virtanen, S. V. Hausen and T. Laine*. (*J. Agric. Sci.* 27, 3 (July, 1937), pp. 332-348 + 1 plate.)
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Crops and Fertilizers

- The Potato in its Early Home and its Introduction into Europe (*continued*). *R. N. Salaman*. (*J. Roy. Hort. Soc.* 62, 6 (June, 1937), pp. 253-266.)
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- Field Trials with Pedigree and Poligenous Strains of Grasses. *M. T. Thomas*. (*Welsh J. Agric.* 13 (1937), pp. 160-172.)
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Dairying

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The Control of Apple Scab; Allington Pippin and Newton Wonder, 1936. *W. Goodwin, N. H. Pizer, E. S. Salmon and W. M. Ware*. (J.S.-E. Agric. Coll., Wye, 40 (July, 1937), pp. 9-17.)

An Account of a Disease of Lawns caused by a Parasitic Fungus. *W. R. Ivimey-Cook*. (J. Bd. Greenkeep. Res. 5, 16 (Spring, 1937), pp. 18-22 + 1 plate.)

The Apple Leaf Miner (*Lyonetha clerckella*) (from Insect and Other Pests of 1936). *A. E. Cameron*. (Trans. Highl. Agric. Soc. Scot. 5th Series, 49 (1937), pp. 147-150.)

Poisonous Plants

Poisoning by Ragwort. *N. Bisset and J. Rees*. (Welsh J. Agric. 13 (1937), pp. 321-325.)

The Chemistry of Stock-Poisoning Plants. *J. F. Couch*. (J. Chem. Educ. 14, 1 (Jan. 1937), pp. 16-30.)

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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No. 8

November, 1937

NOTES FOR THE MONTH

Nutrition and Agriculture

In their Interim Report the Mixed Committee of the League of Nations dealt exhaustively with the physiological aspects of the nutrition problem. In the Final Report* they are mainly concerned with its agricultural and economic implications; but as the volume is intended as an expression of their views on the problem as a whole, a section on "Nutrition and Health" is repeated from the earlier report.

The sections dealing with agriculture range over a wide field. This subject is approached by considering the relationship of agriculture, throughout the world, to food requirements resulting from progress in nutrition. The report suggests that an increased concentration on the production of protective foods in certain countries is required and a relative lessening of the importance of the energy-bearing foods. It is pointed out, however, that existing diets of the poorer classes in many countries are deficient in energy-bearing foods, so that "for a long time to come the increase in the demand for the energy-bearing foods among these population groups will, if nutrition policy achieves its objective, much more than counterbalance the fall in the demand for them which accompanies the qualitative improvement in the diet of those who are already securing an adequate quota of calories."

After giving instances of successful adaptation of agriculture to changing demand, which has occurred, not only in Denmark, to which country the report specially alludes, but in a number of other countries, it proceeds to discuss the

* Final Report of the Mixed Committee of the League of Nations on the Relation of Nutrition to Health, Agriculture and Economic Policy, Official No. A. 13. 1937 11A. pp. 327. Geneva 1937; London; Allen and Unwin. Price 7s. 6d.

NOTES FOR THE MONTH

obstacles that stand in the way of further adaptation; the effects of recent changes in agricultural methods; and the influence of improvements in nutrition on the demand for agricultural products. Amongst the obstacles, the most important in Continental Europe are the special mentality of the peasant, the form of existing capital investment, and the protection given to certain types of produce. Stress is laid on the difficulties created by lack of capital and badly organized distributive services and on the benefits of agricultural co-operation.

The report then discusses the relation of food prices to consumption and the factors affecting prices. The adverse effects, from the point of view of nutrition, of a policy resulting in high prices, such as occurs in certain Continental countries, are naturally commented on. The Committee, however, recognize that these considerations are "not the only ones determining agricultural policy," but they urge that Governments should give due weight, in framing their policy, to "considerations of a nutritional order."

The chapter concludes with sections dealing with price and production control and with distribution costs. The Committee, however, comment sparingly, merely observing that price and production control is a "powerful weapon" and that the interests of nutrition should be given weight in its use. They conclude their discussion of distribution costs by remarking that the milk trade is a particularly important field where improved methods of distribution are needed.

The final chapters of the report deal with the relation of income and education to nutrition and with the evidence of malnutrition in certain countries. Under the latter head is summarized a large amount of information that has been collected, first in regard to the United States, a country in which the statistical study of food consumption has been pursued in considerable detail and a large number of dietary records collected, and, secondly, in Western Europe, where information of particular interest has been obtained in Sweden, Norway and other countries. The chapter then refers to such information as is available for South Africa and Australia, Central and Eastern Europe, Asia, and colonial areas.

This report, which concludes the work of the Mixed Committee of the League of Nations, follows upon the four previous volumes issued by it. Of these, the first consisted of a general review of the problem of nutrition; the second was

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concerned with the physiological basis of nutrition and contained a statement of the standards of nutrition agreed upon by the Technical Commission of the League Health Committee; the third contains a survey of steps recently taken by Governments, public authorities, and national organizations in some twenty countries, to improve the nutrition of different classes of the population; while the fourth, largely based on an investigation undertaken by the International Institute of Agriculture at Rome, attempts to assemble and classify such statistical information as is available on food production, consumption and prices in various countries, particularly in relation to protective foods. The whole series constitutes an important and exhaustive study of the various aspects of a problem that is intimately related to the general question of public health throughout the world, a subject to which increasing attention has been paid in recent years.

Land Fertility Scheme

Although the Scheme, which was dealt with at some length in the October issue of the Journal, has been in operation only since September 6, some indication of the results already achieved may be gathered from the fact that the number of producers of lime and basic slag who had been approved under the Scheme on October 25 approached the 400 mark, while the number of approved distributors exceeded 3,000. The number of applications for Exchequer contributions received by the Land Fertility Committee exceeded 14,000, and a considerable number of applications in respect of deliveries already made had, it is understood, yet to be submitted.

Young Farmers' Clubs: The Minister's Address

On October 20 the Minister of Agriculture, The Rt. Hon. W. S. Morrison, M.P., addressed the annual meeting of the Young Farmers' Clubs. After expressing his own deep interest, and that of his Department, in the Young Farmers' Clubs movement, Mr. Morrison referred to the gap that exists in rural education; that is to say, when the boy or girl leaves the elementary school it may be some time before he or she can get the opportunity of going to a farm institute, agricultural college or other centre of real rural learning. He thought that the Young Farmers' Clubs had stepped into that breach and provided a continuance of rural education that, without their

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endeavours and existence, would not generally exist. That was a very valuable thing for the countryside and for agriculture, because an important problem in agricultural education to-day was that of making available in the field the results of the laboratory and of scientific research. That very real problem was being tackled in many ways.

The Minister said that the County Agricultural Educational Service, to the cost of which the Ministry contributes 60 per cent., is doing great work in that way, but in some parts of the country the farmers are not, perhaps, even yet fully alive to the wealth of scientific assistance that lies at their doors.

Let them consider the effect in future years, and indeed in the present, that this Young Farmers' Club Movement would have with regard to that particular problem. "I am glad to know," continued the Minister, "from my study of your activities, that a great deal of credit must be given to Agricultural Organizers in the counties for the help they have given the Young Farmers' Clubs. Indeed, I have been profoundly impressed by the way in which these officers, hard-worked as they frequently are, have given what is needful to the Young Farmers' Clubs by doing, what is necessary in any real service, something more than their duty. It is precisely in the centres where the Agricultural Organizers have exceeded what anyone could demand of them and have taken a real interest in the working of the Clubs that you see the most forward progress being made.

"I am glad to think that the Young Farmers' Clubs are taking an interest in grass land—I know of your association with the Welsh Plant Breeding Station and so on—but I earnestly hope that, as part of this national educational effort which we are making towards the improvement of grass land, some of the bright brains which exist in the Movement will think of some way in which you can help that campaign of ours.

"There are two bodies which have helped us, and I gratefully acknowledge their assistance, the Carnegie United Kingdom Trust and the King George Jubilee Trust. The Carnegie Trust have in the past matched even the generosity of the Ministry of Agriculture by giving pound for pound with regard to our direct grants which are now, as you know, £1,200 a year. The Ministry's direct grant is now to be supplemented by the indirect grant, which we are making in the shape of repayments to the County Councils of 60 per cent. of their grants to the Federation. The Carnegie Trust has recently

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promised for the years 1938 and 1939 to match the whole of the Ministry's direct and indirect grants up to a total of £1,800 a year.

"As a result, I am glad to be able to announce that I have the authority of the Treasury to continue the Ministry's grants to the National Federation of Young Farmers' Clubs in the next two years on a basis that will ensure that, provided there is no falling off in County Council contributions, the direct and indirect grants, taken together, will amount to £1,800 a year. I have, however, to make clear that the direct grant is not intended to be continued after 1939, but no such limitation in time is imposed upon the indirect grant. That puts us in a position to look at the future with a little more confidence.

"I would like to acknowledge, with gratitude, the assistance which has been given to your Movement by the National Farmers' Union. We are very grateful indeed for their help. Perhaps I may say I hope that they will consider also entering into the competition between the Ministry and the Carnegie Trustees. There is nothing like a little competition in these matters.

"I particularly hope that the County Councils will take this matter into consideration, in view of the value of the Clubs in the county agricultural educational system, and of the discontinuance, after 1939, of the direct grant from the Ministry of Agriculture. I have to make that statement now, and I hope the County Councils will take it to heart and realize what a field for service in the educational world there lies in the Clubs. My predecessor, Mr. Walter Elliot, as Minister of Agriculture last year, earnestly commended the Movement to the County Councils. The response of the County Councils has been, so far, favourable. Their contributions in the present financial year will amount to £1,000. That I hope is only a beginning. We look forward to County Councils in future years giving higher contributions to the National Federation of Young Farmers' Clubs, so as to enable the Federation not only to continue, but greatly to extend its activities."

Linton Village College

Linton Village College in Cambridgeshire was opened on October 14 by the Right Hon. the Earl of Feversham, Parliamentary Secretary to the Ministry of Agriculture and Fisheries. About 600 people were present and before the opening

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ceremony the building was dedicated by the Right Rev. the Lord Bishop of Ely. The Chairman of the Cambridgeshire County Council (Councillor H. Franklin) presided.

This Village College is designed to serve as a community centre of education, recreation and social life for a group of eleven villages with a total population of about 5,000. During the day the building houses the Senior School, the aim of which is to give country children of 11 to 15 years old a training that will fit them for life and work in the countryside. * In addition to the usual subjects, substantial attention is given to woodwork, elementary engineering, household crafts, gardening and physical training. An important feature of the school is the midday meal, which is provided at a charge of 2½d. each to most of the pupils, a number of whom take milk under the scheme for the supply of milk to schools.

The buildings have been designed so that they may be adequate for adult use, for agricultural demonstration and instruction, for further education, and for social activities.

In declaring the building open Lord Feversham said that Cambridgeshire might properly congratulate itself on being in the van of progress in making provision for these colleges, Linton being the third example, which began with the opening of the Sawston Village College seven years ago, followed by the College at Bottisham, opened in May last. Some people might think it strange that a representative of the Ministry of Agriculture should be associated with the opening of such an important educational institution as the Linton Village College. Cambridgeshire, however, had realized, with very great wisdom, that the welfare of the agricultural industry was largely dependent upon the educational needs of the countryside being met. Those who are closely and practically connected with the land knew that the prosperity of agriculture would in the long run depend upon the provision of improved educational facilities in villages as much as upon any other single factor.

The encouragement of a more vigorous community life in the villages would help very greatly to check the drift of young men and women from the country to the town. The policy of providing village colleges was the right one to pursue, The educational plan to be followed at Linton College would give young minds a zest and an enthusiasm to acquire greater scientific knowledge. It was important that the scientific education provided should have as its fundamental background

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an ordinary everyday knowledge of agriculture. It was not always possible for a farmer to send his son to one of the centres of agricultural education. Rather it was necessary for agricultural education to be taken to the farmer and his son. That education the Village College would provide through the Warden, working in close co-operation with the County Agricultural Organizer.

The East Sussex School of Agriculture

About 1,000 guests attended the opening, by the Rt. Hon. W. S. Morrison, M.P., Minister of Agriculture and Fisheries, of extensions to the East Sussex School of Agriculture, at Plumpton, on September 29, 1937.

In his introductory remarks, the Chairman (Capt. G. V. Baxendale, Chairman of the County Agricultural Committee) referred to the work performed by the veterinary staff in the county, and said that the Committee were concerned as to the future of that work in view of the Ministry's Scheme for centralizing the veterinary services.

Mr. Morrison said that the whole problem of animal diseases was one for national attack, and it was for that reason alone that a change in policy was being undertaken. He realized, however, the benefit of the local knowledge and contacts built up by veterinary officers in counties as advanced as East Sussex, and he gave the assurance that the change over to a Government service would be effected with the utmost desire to disturb these contacts as little as possible, and to merge in the new Scheme all the advantages, which were consistent with efficiency, of the old.

The Minister, continuing, said that, for the farmers of East Sussex and beyond its borders, Plumpton stood for one of the best farm schools in the country. Briefly outlining the history of the school, which was established as a Farm Institute, with accommodation for 18 students, in 1926, he said that the need for enlargement soon became evident and the present extensions were decided upon last year, at a cost of £22,000. As a result of these extensions, hostel accommodation was more than doubled; laboratories, lecture rooms and a residence for the Vice-Principal had been added; and the School was now able to house 40 students and to provide courses for women students.

The fact that a fair proportion of the students were sons of professional men showed that the School was conducting something in the nature of a "back to the land" movement; at the

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same time, farmers were as anxious as professional people that their sons should attend the School. Great importance was attached to the fact that 90 per cent. of the 262 students who had passed through the School were now engaged in farming, or otherwise occupied in agriculture. Dealing with the question of institutional instruction, the Minister pointed out that those who benefited from the facilities were not confined to the administrative area of the County—the facilities were equally available to residents in the County Boroughs of Brighton, Eastbourne and Hastings. In regard to rural bias in the teaching in senior elementary schools, the Minister said that he hoped that much would result from the co-operation that would now be possible between the County Agricultural Education Sub-Committee and the County Education Committee, as the result of the appointment of a Joint Committee representative of the two bodies.

At the end of his speech, Mr. Morrison was presented by Mr. Burdett-Coutts, on behalf of the County Agricultural Committee, with mementoes of his visit. After prizes had been distributed to students by Mrs. Baxendale, the guests were entertained to tea, and invited to inspect the building.

Exportation of Horses—Effect of New Act

The Ministry of Agriculture desires to draw the attention of all persons concerned in the exportation of horses to the provisions of the Exportation of Horses Act, 1937, which came into operation on October 1, 1937.

The existing regulations contained in the Diseases of Animals Act, 1910, as amended by the Exportation of Horses Act, 1914, prohibit the export of any horse, ass or mule from any port in Great Britain to any port in Europe outside Great Britain, Northern Ireland, the Irish Free State, the Channel Islands, or the Isle of Man, unless immediately before shipment the animal has been examined by a veterinary inspector of the Ministry and certified by him in writing to be capable of being conveyed by sea and disembarked without cruelty, and also to be capable of being worked without suffering. The new Act of 1937 adds to the requisite qualification of fitness to travel and to work without suffering the further qualification that in certain instances specified below, the animal is, in the opinion of the Inspector, not more than eight years of age and also of not less value than certain specified amounts. The instances above

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referred to are where the Inspector is satisfied that the animal is :—

- (a) a heavy draught horse ;
- (b) a vanner, mule or jennet ; or
- (c) an ass,

and the amounts referred to in relation to (a), (b) and (c) respectively are £25, £20 and £3.

The Act of 1937 provides, however, that the above provisions relating to age and value shall not apply to any animal as to which the inspector is satisfied either—

- (a) that it is intended to use the horse as a performing animal, or
- (b) that the horse is registered in the stud book of a society for the encouragement of horse breeding recognized by the Ministry and is intended to be used for breeding or exhibition, or
- (c) that the horse is a foal at foot accompanying such a horse as is referred to in the preceding paragraph (b).

The Act of 1937 further provides that if any horse (including ass, mule or jennet) presented to the inspector for examination before shipment is found by him to be in such a physical condition that it is cruel to keep it alive, or to be permanently incapable of being worked without suffering, the inspector must slaughter the animal or cause it to be slaughtered with a mechanically operated instrument, and no compensation is payable to the owner of the animal.

In all other respects the existing regulations continue in operation unchanged, and any shipping company or railway company intending to ship horses, asses or mules to any port or place on the Continent of Europe outside Great Britain, Northern Ireland, the Irish Free State, the Channel Islands, or the Isle of Man, must give notice of the intended exportation to the veterinary inspector of the Ministry at the authorized ports of shipment in accordance with the Exportation and Transit of Horses, Asses and Mules Order of 1921. The authorized ports of shipment are London (including Tilbury), Southampton, Folkestone, Harwich, Goole, Hull and Leith.

Prevention of the Introduction of Foreign Pests and Diseases

Regulations governing the entry into this country of plants and plant products from abroad have been in force for many years. The policy of the Ministry in this matter may be summarized in the statement that “ although a certain measure of risk must always attend the entry into the country of trees,

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plants or living plant material from overseas, that risk is minimized by the issue of health certificates by duly authorized officers of the Phytopathological Service of the country of origin, and is outweighed by the advantages obtained by the introduction of new varieties and new strains of old varieties." Experience gained in the administration of the Orders, however, showed that there are some pests, the presence of which cannot readily be detected during an examination of the produce immediately before export, e.g., the Chrysanthemum Midge, while the destructive nature of others, e.g., the Colorado Beetle, renders it unsafe to permit the importation of their host plant or its produce.

The present regulations are embodied in the Importation of Plants Order of 1933 and the various Amending Orders of 1934 to 1937, which require that all living plants and potatoes imported from overseas shall be accompanied by official certificates of health, and which prescribe certain prohibitions and restrictions in respect of produce grown in the United States of America, Canada, France, Belgium, Germany, and Luxemburg on account of the presence of the Colorado Beetle in those countries.

As an additional safeguard against the introduction of the Chrysanthemum Midge and of virus diseases of sugar beet and mangold, the landing of living plants of Chrysanthemum and *Beta vulgaris* is prohibited except under licence from the Ministry.

A summary of the main provisions of these Orders may be obtained free of charge on application to the Ministry.

Interesting Birds: (9) The Spotted Flycatcher

The Spotted Flycatcher, which has a number of local names, such as " Beam-bird," " Post-bird," and " Cobweb," is fairly common in this country. It is a migrant, arriving here in May and leaving in autumn for Africa, where it winters. The term " spotted " is much more applicable to the young birds than to the adults, as the former are much more distinctly marked with brownish streaks and spots, especially on the underparts, than are their parents.

The Spotted Flycatcher frequents orchards, gardens, plantations and woods, and has an especial liking for large old gardens. It feeds entirely on insects, and although it is sometimes accused of taking fruit there is no evidence that it really does so. Such local names as " Cherry-eater " are, therefore,



Photograph Copyright by Eric I. Hosking.
The Spotted Flycatcher

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quite unjustifiable. The Spotted Flycatcher may often be seen in late spring and summer, taking characteristic short flights in pursuit of insects and returning to its coign of vantage on a post or rail, or the branch of a tree. This habit is of great assistance in identifying the bird.

The nest of the Spotted Flycatcher is a neat structure of moss, grass, wool, hair and lichen, warmly lined with feathers. Moss is nearly always used in quantity. The nest is placed in a hole in a wall, the fork of a tree, on a beam in a porch or outhouse, a ledge of rock, or on a tree stump. Occasionally the bird uses an old nest of some other bird, renovating and adapting it and putting in a new lining, or even building an entirely new nest inside the old one. The eggs usually number 5, occasionally 6, and vary in colour from pale green to bluish white, prettily mottled with rust colour and purplish red.

The Spotted Flycatcher's insectivorous habits and general harmlessness should commend it to the farmer, the gardener, and the fruit grower. It destroys many pests, and should be encouraged in every possible way. It will often use artificial nest boxes of the half-open type.

Rothamsted Winter Lectures

Sir John Russell, Director of the Rothamsted Experimental Station, has again arranged that Mr. H. V. Garner, Guide-Demonstrator of this institution, and other members of the staff, shall be available during the winter to deliver lectures on the experimental work of the station to members of chambers of agriculture and horticulture, farmers' clubs, farm workers' associations, agricultural societies and similar organizations. No fee will be charged for the lecturers' services, but participating societies will be expected to defray travelling and hotel expenses, and to make the necessary arrangements with the lecture-staff. Requests for lectures should give as long notice as possible. A syllabus of lectures and lecturers may be obtained on application to the Secretary, Rothamsted Experimental Station, Harpenden, Hertfordshire.

Seed Potato Frauds

A few weeks ago proceedings were taken by the City of Birmingham against a local potato merchant on charges of obtaining money by false pretences in connexion with sales of seed potatoes.

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This merchant had supplied a local farmer, in the spring of 1936, with a considerable quantity of seed potatoes, all being sold as Irish certified seed. When the seed was grown on, by far the larger part of the crop was found to be of inferior quality and affected by disease, and when the case was investigated it became clear that, as regards the consignments complained of, the merchant had not delivered the Irish seed which he had contracted to supply. The crop raised from these consignments was practically worthless and the farmer suffered a heavy financial loss. The case was brought to the notice of the City authorities by the Ministry of Agriculture and Fisheries, which, in consultation with the Irish Free State authorities, had been considering the desirability of prosecuting the merchant for offences against the Seeds Act, 1920, and the Wart Disease of Potatoes Order, 1923. Prosecution under the Larceny Act, 1916, for obtaining money by false pretences was, however, decided on as being the most appropriate charge having regard to the magnitude of the offence. The defendant, who pleaded guilty, was fined £25 on each of two charges, with £5 5s. costs.

For their own protection, buyers of seed potatoes should see that the particulars that have to be declared by the vendor under the Seeds Act and the Wart Disease of Potatoes Order are delivered to them *in writing*. A copy of a pamphlet (Form C. & S. 66A), explaining in a convenient form the statutory requirements in regard to the sale of seed potatoes, can be obtained free of charge from The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

AGRICULTURE ACT, 1937

PART IV (DISEASES OF ANIMALS)

The announcement made by the Minister of Agriculture in the House of Commons on May 27, 1937, on the Government's proposals for increasing productivity included the following statement:—

The Government also propose to initiate a large-scale campaign for the eradication of animal diseases in Great Britain. Our object is to improve the health of our live stock and increase agricultural productivity by seeking to eliminate what is perhaps the worst of all forms of wastage and economic loss in agriculture. In the first instance, efforts will mainly be directed to the eradication of disease among our cattle. The scheme will involve an additional charge on the Exchequer of about £600,000 per annum for the first four years. It will, however, involve centralization of public veterinary services and as against this increase the expenditure by local authorities will be reduced by about £170,000. Parliamentary authority will be required for these proposals; the Government are anxious, however, to lose no time in developing the existing scheme of control of disease and accordingly I am arranging at once to amend the Attested Herds Scheme by providing additional assistance in England and Wales as has already been done in Scotland to owners of dairy stock who are desirous of eradicating tuberculosis from their herds. This revised scheme will become operative on June 1 next.

The necessary legislation will be introduced to give effect to the aforementioned measures at the earliest possible moment and Parliament will be invited to pass it into law before the Summer Recess.

The proposals were explained more fully in the Memorandum on the Financial Resolution dated June, 1937,* and the necessary powers to give effect to them were conferred by Part IV of the Agriculture Act, 1937, which received the Royal Assent on July 30. The Act provides that Part IV shall come into operation on a date to be fixed by order of the Minister of Agriculture and Fisheries. The date provisionally fixed is January 1, 1938, but in view of the large amount of preliminary work necessary it is not yet possible for a definite announcement to be made on the subject.

The campaign envisaged by Part IV of the Act, which, as indicated in the Minister's announcement on May 27, forms a part of the Government's policy for increasing productivity, marks a new stage in the fight against animal diseases. In the main, State action in relation to diseases of animals has hitherto been directed against those diseases that, if unchecked, would spread rapidly in epidemic fashion throughout the

* Cmd. 5493.

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herds and flocks of the country. A considerable measure of success has attended such action. Unfortunately, the position as regards certain other cattle diseases that spread in a more insidious manner, notably tuberculosis, has steadily deteriorated.

The Report of the Gowland Hopkins Committee on Cattle Diseases* (1934), contained certain very important but disturbing facts indicating the heavy losses due to diseases amongst live stock. That Committee estimated:—

(a) that 58 per cent. of dairy cattle leaving herds were disposed of on account of disease;

(b) that the average productive life of dairy cattle under the existing conditions was in the neighbourhood of $4\frac{1}{2}$ years, or only half that which might be expected if the herds were free from the ravages of disease;

(c) that about 40 per cent. of the cows are infected to a varying extent with bovine tuberculosis and about the same proportion with contagious abortion; and

(d) that on account of tuberculosis the annual loss due to the necessity of maintaining herds at full strength and to meat condemned was about £3,000,000 per annum, without taking account of the loss in productivity during life.

On the available data tentative estimates of the total losses from diseases in livestock of all kinds indicate that it is of the order of magnitude of £14,000,000 per annum, or 10 per cent. of the output of the meat, poultry and dairying industries of this country. The eradication of disease is thus one of the most important steps that can be taken to improve the permanent assets and resources of the industry.

The cattle population of Great Britain approaches 8 million, including $3\frac{1}{2}$ million cows and heifers in milk or in calf. On agricultural grounds alone there is an urgent need for a forward drive against disease, while considerations of defence and the necessity for increasing productivity demand a reduction of the serious toll of wastage revealed by the Gowland Hopkins Report, wastage that farmers can never hope to eliminate by their own unaided efforts.

In the first instance attention will be mainly directed to bovine tuberculosis, supplemented by action designed to facilitate the voluntary elimination of contagious abortion in tubercle-free herds. The following is an outline of the measures that it is proposed to adopt when Part IV of the Act comes into operation.

* Economic Advisory Council: Report of Committee on Cattle Diseases (Cmd. 4591).

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Routine Clinical Inspection of Herds. The routine veterinary inspection of dairy herds under the Milk and Dairies Acts and Orders, at present the responsibility of local authorities, will in future be carried out by the State Veterinary Service (see below). Owing to financial and other considerations, practice in regard to frequency of inspection in England and Wales, apart from the periodical inspection of "Accredited" and "Tuberculin Tested" herds, varies considerably as between one county and another. The objective will be to secure a greater measure of uniformity in this respect, but not by lowering the high standard attained in some areas. It is anticipated that in the course of routine inspection, given the co-operation of stockowners, much valuable information will be gained in regard to the incidence of such diseases as contagious abortion, Johne's disease and mastitis, and other causes of serious loss amongst live stock.

Tuberculin Test Survey of Self-contained Herds. The herds that will reveal the lowest incidence of tuberculosis are self-contained. A necessary step in the eradication campaign will be to ascertain the herds (whether milk producing herds or not) that are free from disease, or nearly so, since precise information on the incidence of disease, and the disclosure of the areas or localities in which eradication efforts are likely to produce the most fruitful results, must form an essential basis of action. With this object it is proposed:—

- (i) to locate the self-contained herds, and
- (ii) to carry out a systematic tuberculin test survey of them as quickly as practicable.

The information necessary to arrange the survey will be obtained in two ways; first by means of the questionnaire sent in September to all occupiers of agricultural holdings on which cattle are kept, the replies to which are now being examined and tabulated; and secondly, by Veterinary Inspectors in the course of their routine inspections of cattle in dairies.

Voluntary Attestation Scheme. Section 20 of the Act, which will replace Section 9 of the Milk Act, 1934, under which payments are made to owners of milk-producing herds attested under the Attested Herds Schemes, provides for the continuance of assistance until January 31, 1941—an extension of two years of the four-year period contemplated under the Act of 1934—

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and at the same time broadens the basis on which the payments to stockowners may be made. Under these new powers it is proposed to extend the present Attested Herds Schemes so as to enable payments corresponding to the milk bonus paid to owners of attested dairy herds to be made in respect of herds maintained primarily for beef production. A further announcement on this subject will be made in due course.

Meanwhile, the revised voluntary attestation scheme for England and Wales, which came into operation on June 1, 1937, and embodied new features, including provision for assisted tests of herds having not more than about 10 per cent. reactors, is making satisfactory progress. In the four months June-September the number of herds attested in England and Wales increased by 220 (from 280 to 500) or by nearly 80 per cent.; while at the end of that period some 500 applications for assisted tests and attestation were before the Ministry.

The Tuberculin Test Survey will disclose many herds containing few or no reactors, and it is confidently expected that when the owners learn the true state of their herds, many of them will desire to proceed with attestation after further testing under the revised scheme and the elimination of reactors (if any). A substantial increase in the number of attested herds in particular localities will open the way to more comprehensive methods of dealing with tuberculosis in cattle by means of control areas.

Establishment of Attested Areas. Although there is no short cut to the eradication of bovine tuberculosis, much may be done to reduce its prevalence by the introduction of new control measures in defined areas where there is a comparatively low incidence, and by the gradual extension of these areas on the lines pursued with success in the United States, Canada and elsewhere.

It is accordingly proposed to inaugurate a four-year plan for the cleaning up of areas that are known or found as a result of the Tuberculin Test Survey to have a low incidence of tuberculosis. In the areas selected, the plan would, at first, proceed on a voluntary basis, owners being encouraged to apply for attestation in suitable instances. When a substantial majority of the cattle is free from disease, the area would be declared an eradication area subject to movement control, and non-attested herds would be officially tested and the reactors destroyed with payment of compensation. The area would then

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be declared an attested area, the movement of cattle being controlled so as to prevent infection being brought in from outside. By this means it is expected to establish a substantial reservoir of tubercle-free cattle, a reservoir that should be progressively enlarged in subsequent years by the extension of the clean areas and the selection of other areas for similar treatment.

Contagious Abortion. In carrying out these proposals, information will be accumulated on other diseases of animals, and the way thus prepared for measures to eradicate them. The most serious of these diseases is contagious abortion. The control of this disease has for some years been demonstrated to be practicable, but the measures necessary have not been used to any appreciable extent in this country. It is, therefore, proposed to frame a scheme whereby the owners of all herds that have been officially tested and found to be free from tuberculosis will be assisted, by providing free veterinary advice and free blood testing, to protect such herds as are already free from abortus infection and to eliminate disease from the abortus-infected herds. The scheme will include provision for official certification as to freedom from contagious abortion when the disease has been eradicated from the herd.

Poultry Diseases. Under the powers conferred by the Diseases of Animals Act, 1935, with respect to poultry diseases, Orders have been made for three main purposes, viz:— (1) scheduling the most serious of the exotic diseases that, if introduced and allowed to spread, might have disastrous consequences to the industry, namely the diseases fowl plague and Newcastle Disease, which are included in the term fowl pest; (2) safeguarding poultry flocks from the risk of the introduction of disease from abroad; and (3) checking the spread of the more common diseases by requiring the disinfection of poultry market pens and of receptacles, and prohibiting the exposure in markets of birds in an obvious state of ill-health.

The whole problem of the heavy mortality among poultry is under examination by an expert committee, and consideration of any more comprehensive scheme for dealing with poultry diseases must be deferred pending the receipt of their recommendations.

For this reason the measures that it is proposed to introduce in due course, under the powers conferred by Section 24 of the

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Agriculture Act, 1937, will be limited to the promotion of the breeding and distribution of stocks of poultry that are free from disease, by providing free veterinary services for owners of approved poultry breeding stations in regard to the inspection, testing and examination of poultry, whether alive or dead.

Centralized Veterinary Service. An eradication campaign of the magnitude contemplated necessitated a review of the existing organization of the public veterinary services. There is at the present time under the control of the Minister of Agriculture and Fisheries a State service that deals centrally with certain phases of the work under the Diseases of Animals Acts throughout Great Britain, viz: the measures against foot-and-mouth disease, swine fever and rabies. The other duties of the State service include the examination of all imported animals from Ireland, Canada, Channel Islands, Isle of Man, etc., which number nearly 1½ million annually; the supervision of the administration by local authorities of Orders of the Minister relating to other diseases such as anthrax, sheep scab, tuberculosis, parasitic mange of horses, etc.; and duties under the general Orders for the prevention of the spread of disease and the prevention of avoidable cruelty in the transit of live-stock.

Certain veterinary services are also provided by local authorities. They are undertaken by veterinary inspectors appointed to inquire into reported cases of anthrax, sheep scab, tuberculosis and parasitic mange, and to carry out the examination of cattle for the purposes of the Milk and Dairies Acts and Orders, including the Milk (Special Designations) Orders, which require the routine clinical examination of herds whose owners hold licences under the Orders authorizing them to use the designations "Tuberculin Tested" and "Accredited" (in England and Wales) and "Certified," "Tuberculin Tested" and "Standard" (in Scotland).

The Government came to the conclusion that in order to secure the efficient conduct and uniform administration throughout Great Britain of a national campaign of the character in view, the public veterinary services relating to animal diseases should be centralized under the control of the Minister of Agriculture and Fisheries. Contagious disease knows no frontiers and it is considered that uniform action under a single authority pursuing one policy and having one standard is essential for success in combating it.

AGRICULTURE ACT, 1937, PART IV

Section 19 (1) of the Agriculture Act, 1937, accordingly provides that—

As from the commencement of this Part of this Act, the functions of veterinary inspectors in Great Britain under the Diseases of Animals Acts, 1894 to 1935, and any enactments relating to milk or to dairies, and the functions of veterinary inspectors in England and veterinary officers in Scotland under any arrangements made by virtue of section nine of the Milk Act, 1934, shall, in accordance with directions given by the Minister, be discharged by veterinary inspectors appointed for the purpose by him under section five of the Board of Agriculture Act, 1889, and the provisions of any enactment relating to such functions shall have effect accordingly.

Local authorities will retain all their functions in relation to meat inspection, and those under the Milk and Dairies Acts and Orders and under any other enactments relating to milk except only in relation to the veterinary inspection of animals. They will also retain their important powers and duties of a non-veterinary character under the Diseases of Animals Acts, including the local enforcement of all general Orders of the Minister.

The transfer of the veterinary functions of local authorities to the Ministry involves the transfer to the veterinary staff of the Ministry of whole-time veterinary inspectors of local authorities engaged upon the duties to be transferred. It is intended to invite such veterinary inspectors to accept appointment under the Ministry subject to the conditions which normally attach to the State veterinary service. There will be no formal transfer to the Ministry of the part-time veterinary inspectors employed by local authorities, but it is contemplated that the services of the majority of these officers will be utilized on a part-time basis for some of the duties that will have to be discharged by veterinary inspectors in connexion with the working of the new proposals.

The constitution of a State veterinary service on comprehensive lines and the coming into operation of Part IV of the Agriculture Act, 1937, will mark the inauguration of a new phase in the attack on animal diseases in this country. The rapid progress that is now being made with the Attested Herds Scheme is a happy augury for the future, and with the continued co-operation and goodwill of local authorities, the veterinary profession and the agricultural community, there is every prospect that striking results will be achieved during the next few years.

THE AGRICULTURAL RESEARCH COUNCIL'S FIELD STATION

The Agricultural Research Council, acting under the direction of the Committee of the Privy Council for the Organisation and Development of Agricultural Research, and after consultation with the Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland, have purchased from Mr. Alfred Barclay the Compton Manor Estate of about 1,500 acres, on the Berkshire Downs, about 16 miles to the west of Reading.

The objects of the Council in establishing a Field Station of their own are twofold, and have been adopted after a careful survey of existing facilities for agricultural research.

(1) It is hoped to supply from Compton to Agricultural Research Institutes for experimental purposes animals of known history and free from disease; for these there is a demand which it is becoming increasingly difficult to meet. The Council are, therefore, also buying from Mr. Barclay his well known herd of pedigree Ayrshire cattle and his smaller herds of pedigree Friesian and Guernsey cattle, which have for some years been under expert supervision by two Veterinary members of one of the Council's own Committees. All the cattle are free from tuberculosis, and two of the three herds are free from contagious abortion and mastitis. The herd of some 300 Large White pigs, which is being purchased by the Council, is also free from tuberculosis.

(2) The Council desire to fill a gap in the existing facilities for research by providing opportunities for experiments on a field scale under strictly controlled conditions. Such experiments will be related, in particular, to those problems of animal health and disease which fundamental and smaller scale investigations conducted at Research Institutes, or initiated by the Council, may indicate are at a stage requiring the use of animals in larger numbers than can be accommodated at an Institute without detriment to its general programme. A section of the Estate will be isolated, and cattle units will be built as soon as possible for the first series of experiments on contagious abortion in cattle. In the course of their management of the

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Estate, the Council will also undertake any experiments with pastures and crops which can usefully be done there.

With the consent of the Medical Research Council, the Agricultural Research Council have appointed Mr. G. W. Dunkin, M.R.C.V.S., D.V.H., at present Superintendent of the Farm Laboratories of the Medical Research Council at Mill Hill, to be Director of the Field Station at Compton. Mr. Dunkin will be assisted by a small scientific staff. A laboratory and houses for the breeding and maintenance of stocks of small laboratory animals will be built on the Estate.

The need for a Field Station of the type now to be established arose in the first place from the requirements of the Council's Committee on *Brucella abortus* Infection in Animals (Contagious Abortion) and Man. Of this Committee, Sir Joseph Arkwright is the Chairman, and among its members are the principal workers on contagious abortion in Great Britain. The Council's Committee were asked to consider, in the light of the recommendations made by the Committee on Cattle Diseases under the Chairmanship of Sir Frederick Gowland Hopkins, how research on contagious abortion could best be advanced. The Committee on *Brucella abortus* Infection were of opinion that it was desirable to conduct experiments with preventive vaccines and in regard to sources of natural infection on a herd of some 200 cattle, divided into a number of strictly isolated units, under the Committee's own control.

It appeared to the Council and to their Animal Diseases Committee that it would be an unwise and an uneconomical step to provide at any one Research Institute, or at two Institutes, accommodation for experiments on a single disease on so large a scale, or to divert the energies of an Institute's staff to so extensive a series of large-scale experiments. The general survey of all agricultural research in progress in Great Britain made by the Agricultural Research Council had brought to light other instances in which facilities for research on a field scale, but under conditions of control which could not be maintained in ordinary farming practice, were required.

Further, in the course of the examination of the scheme of contagious abortion experiments, the desirability of increasing the supply of animals which could with confidence be accepted as being free from certain specified diseases, and whose history had been accurately recorded, had emerged. Agreement was therefore reached that the right course was to establish under

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the Council's control a Field Station which would fulfil these requirements, and, after a most careful search, the Compton Manor Estate was selected. As the examination of the policy to be adopted in using the Estate proceeded, it became evident that opportunities would arise for useful experimentation on crops as well as on animals.

It is the desire of the Agricultural Research Council that their Station should be of value to those who are engaged in agricultural research, and it is hoped that from time to time Institutes will second members of their staff to work at Compton with the small resident staff upon problems for which the Station's resources are most suitable. If, however, the Station is to be put to the best use, the number of major experiments in progress at the same time must be strictly limited. Probably only one series of large scale experiments upon cattle, pigs or poultry respectively should be undertaken at one time.

With *cattle* the first group of experiments will be concerned with contagious abortion. They cannot be begun until the necessary isolation units have been built, and they may last for five or even for ten years; but the fact that animals known to be free from abortion are available at Compton will shorten the period of experiment by three or four years.

With *pigs* it is under consideration, as a result of consultation with the leading workers in pig research, to limit attention in the first instance to the possibility of reducing the rate of early mortality in small pigs—an urgent problem for pig breeders—in a healthy herd run under good commercial conditions.

With *poultry*, observations will be made to test the hypothesis that susceptibility to fowl paralysis is inherited in certain strains of birds. For this purpose birds of known pedigree, which have been under examination by Professor T. Dalling at the Wellcome Laboratories at Beckenham, will be used.

It is not the intention of the Council to develop at Compton a self-contained Research Institute. The resident scientific staff will be small and the laboratory will only be large enough to meet the needs of that staff and of visiting workers from the Research Institutes. Small animals must be bred on a considerable scale for use in connexion with experiments on animal diseases at the Station. The Council can perform a further useful function by breeding a small surplus of healthy small animals for supply to Institutes.

Although the Station is to be used for field scale experiments, the fact that a primary object will be to supply large as well

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as small animals to Research Institutes is a guarantee that the need for developing work with large animals at the Institutes is appreciated by the Agricultural Research Council, who are responsible for giving scientific guidance regarding all agricultural research aided by the Government. The division of functions between the Council's Station and the Institutes has been clearly, though not too rigidly, delimited. It is for the Field Station to provide opportunities for experiments which are at a stage between Research Institute investigations with small groups of animals and ordinary farming practice. In research this stage is a crucial one.

UNTREATED AND INEXPENSIVE MATERIALS AS A SOURCE OF LIME

A. W. OLDERSHAW, B.Sc.,
Agricultural Organizer for East Suffolk

Large areas of land in this country are seriously lacking in lime, and the productivity of this land is in consequence gravely reduced. To a considerable extent, the reason for this lack is geological—certain geological formations contain an abundance of lime, and others very little. Leaching has been active for a very long period, and instances are known where the carbonate of lime, in what was originally a calcareous sand, has been dissolved out until a sand containing hardly any carbonate of lime has been left.

In some industrial districts the process has been accelerated by acid smoke, which, mingled with the rain-water, has rendered the surface soil extremely sour. The habitual leaching of soil by rain-water has been accelerated to some extent by the use of certain chemical manures, but it is possible to over-estimate this influence. Thus, sulphate of ammonia—the chemical manure that has the most serious effect in this direction—causes a loss only about equal to its own weight of carbonate of lime. Even the most intensively manured soils seldom receive more than an average annual dressing of, say, 2 cwt. of sulphate of ammonia. An annual loss of 2 cwt. of carbonate of lime is only serious in soils extremely poor in that substance, and it can be replaced at an expenditure of about 3s. per acre per annum. Certain manures, such as calcium cyanamide and basic slag, reduce the total loss of carbonate of lime from the soil, but here again, owing to the usual smallness of the dressings the effect is comparatively small. One cwt. of basic slag has, however, about the same lime value as 1 cwt. of calcium carbonate, so that where a dressing of, say, 10 cwt. per acre of slag is applied, the lime effect is definitely worthy of consideration.

In East Suffolk, a field-to-field survey of 12 parishes was made in 1935. A district poor in lime was selected. In 12 parishes containing 25,000 acres the soil of 7,091 acres was deficient in lime to an extent likely to injure seriously such sensitive crops as barley, sugar-beet and clover. A similar survey conducted in 17 parishes in another part of the county in 1936 gave comparable results.

Several bulky materials that contain lime are mentioned in

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the Ministry's Bulletin No. 35.* The effects of two of these—lump untreated chalk, and lime press cake from beet sugar factories (sugar-beet lime sludge) have been studied over a period of years at Tunstall Experimental Station in East Suffolk, and elsewhere.

Modern transport enables lump chalk in its untreated state to be carted by rail or lorry a distance of 30 to 40 miles at economic rates. A considerable proportion of England is within this distance from a chalk pit.

Relative Costs of Certain Materials Containing Lime.

A simple comparison of the cost of transport is possible if Hopton, near Great Yarmouth, is considered as a centre. This station is about in the centre of the seventeen East Suffolk parishes surveyed for lime in 1936. The nearest sources of the first three materials are within a radius of three miles of Ipswich, and all have to be taken about 48 miles by rail or road to Hopton. The Cantley Beet Sugar Factory is the nearest source of sugar-beet lime sludge, and is about 16 miles by road from Hopton.

The following amounts of various "liming" materials supply roughly equal amounts of quicklime or calcium oxide (the valuable constituent in all forms of lime):—

5 tons chalk; $7\frac{1}{2}$ -10 tons sugar-beet lime sludge and chalk ground carbonate of lime; $2\frac{1}{4}$ tons ground burnt lime):

5 tons of chalk formed the basis of the calculation because it was the quantity per acre used in the Tunstall experiments.

The cost of these materials, including carriage, delivered at Hopton Railway Station in East Suffolk, 48 miles from the chalk pits, in October, 1936, was as follows (to the nearest shilling):—

5 tons Lump Chalk at 9s. 2d.	.. ..	= 46s.
$2\frac{1}{4}$ tons Ground Burnt Lime at 44s. 6d.	.. ..	= 100s.
$3\frac{3}{4}$ tons Ground Carbonate of Lime at 28s. 6d.	.. ..	= 107s.
(Cartage to field from railway station must be added in each instance).		
8 tons Sugar Beet Lime Sludge (ex Cantley Beet Sugar Factory) at field at 6s. 6d. per ton		
(carted by road about 16 miles)	.. ..	= 52s.

On the above figures, sugar-beet lime sludge and chalk were, at the selected place, which is quite a considerable distance from chalk pits and beet sugar factory, much the cheapest

* *The Use of Lime in Agriculture.*—A new edition of this Bulletin (No. 35) is in preparation. Readers wishing to be notified of the date of publication should fill in and return the form on p. vii.

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sources of lime, even when cartage from the railway station and cost of spreading are added.

Where the chalk pit or beet sugar factory is much nearer to the farm than this, the advantage of chalk or sugar-beet lime sludge, from an economic point of view, over ground or lump lime or ground carbonate of lime, becomes much more marked, in fact, it becomes overwhelming except where only a small quantity of lime per acre is needed to correct the soil acidity.

The idea that the cost of chalking is very heavy, thus proves a fallacy. A dressing of chalk that is likely to last for a long period can be given, when the material is available within a distance of 20 or 30 miles or less, at no greater cost than a comparatively small dressing of lime, the effects of which may only last a few years.

When finely ground materials are used better distribution can be effected, but it is perhaps possible to pay too highly for this advantage, because equally good and more lasting results can be obtained by using larger quantities of the cheap and untreated materials.

At Tunstall Experimental Station, 20 miles from the chalk pits, 5 tons of chalk per acre costing (including spreading) 50s. per acre, have given extremely good results over a period of ten years, and the effects as yet show no sign of diminution. At this distance from the chalk pits an equivalent dressing of ground burnt or ground carbonate of lime would have cost at least double. In other parts of the county the effects of chalk applied 40 years ago are still visible, but in these places much heavier dressings of chalk were applied.

Chalk: Method of Application. In East Suffolk the chalk is obtained from one of the numerous chalk pits in the Gipping Valley. In one there are several geological strata overlying the chalk, and these must be removed before the chalk can be quarried. Most of them are, however, of economic importance for brickmaking and building purposes. Here the underlying chalk is used for lime burning, whitening manufacture and grinding for agricultural purposes, as well as in bulk. The small lump chalk, unsuitable for lime burning, is excellent for direct application to the land, and some of it consists of comparatively fine particles. In another quarry, which has been opened within the last twenty years, there is only about a foot of overlying material. Here the lorries proceed into the



A crop of Sugar-beet grown in 1935 The small bare squares were unchalked

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pit and are loaded directly from the chalk face. Where motor transport is adopted the chalk is either heaped in the field near where it is required, or if the condition of the land permits (owing to frost or dry weather) the lorries travel over the field and the chalk is spread or heaped directly from them.

East Suffolk chalk is very soft and friable, much more so than certain samples examined from Kent, Lincs. and Oxon.

Where the chalk is put in a large heap in a corner of a field and left for the winter, considerable weathering of the lumps on the surface of the heap occurs, and many of them are reduced to tiny particles. Rubber tyred carts are very useful forcarting the chalk on to the land. Under fairly dry conditions they have been used for carting and spreading chalk directly on to growing wheat during the winter and early spring without doing damage. Lorries also have been taken on to a field of small growing cabbages where the wheels were the right width to go down the rows, and the chalk has been spread direct from the lorries, again without injuring the crop.

Importance of Weathering. When lump chalk is used it is very important to leave it on the surface of the ground, if possible, for a whole winter. There is almost always enough frost to shatter the lumps of a soft chalk, and harrowing in spring effects excellent distribution. Where large lumps of chalk are ploughed under soon after spreading many of them do not break up for a long time, and the beneficial effect of the chalk comes into action only very gradually. On the other hand, if lump chalk is spread after the last ploughing, say, in December, and left on the surface all the winter, it usually gives definite results on such crops as barley and sugar-beet the following spring. The spring tillage will mix it with the soil to a considerable extent, but it will hardly have time to penetrate deeply.

In the first season after applying the chalk, sugar-beet grown under such conditions germinated well, but later in the season their tap roots curved into an elbow shape, owing to inability to penetrate the acid soil below. If, in these circumstances, the land had been ploughed in spring, the chalk would have been turned below, and in all probability the seedling beets would have perished from soil acidity before reaching it.

Lump chalk spread on growing wheat in January benefited the wheat that season, and made the difference between a crop and no crop on the clover sown in the wheat. Here the harrowing given to the wheat distributed the chalk, which was

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then in contact with the germinating clover seedlings, and provided them with the soil conditions they appreciate.

Quantity to Use. The quantity to apply naturally depends upon the acidity of the soil and the purity of the chalk. The chalk occurring in East Suffolk, in its dry state, contains about 98 per cent. of carbonate of lime. The percentage of moisture varies, but an average figure of 70 to 80 per cent. of carbonate of lime may be assumed for this chalk, the remainder being moisture and earthy matter.

Although local tradition said that 10 or even 20 tons of chalk per acre were necessary, it has been found that under the conditions prevalent at Tunstall, 5 tons of lump chalk per acre, well distributed and weathered before ploughing in, is a sufficient dressing and will last at least ten years.

An additional 5 tons of chalk applied in 1932 to a small area has not apparently resulted in increased crops. On another plot a dressing of $2\frac{1}{2}$ tons per acre in 1932 gave good results, but was not sufficient for the degree of soil acidity present.

Financial Return from Chalking. The figures given below show the crops grown on Heath Walk, Tunstall, in the years mentioned, together with the total value of crops, on chalked and unchalked land, per acre. They include certain crops (rye, potatoes, oats and lupins) that are not very sensitive to lack of lime. The value of the straw is not included; all the figures are per acre.

TUNSTALL, SOIL-LIGHT, LIME REQUIREMENT, 27 CWT. OF CARBONATE OF LIME. pH—5·8.

Chalked 5 tons per acre.

Unchalked.

Winter 1925-6.

	Bush.		£	s.	d.	Bush.	£	s.	d.
1927 Rye ..	46·6	at 3s a bush.	6	18	6	42·3	6	7	0
	T.C.								
1928 S. Beet ..	13·6	at £2 a ton	26	12	0	Nil.			—
	Bush.					Bush.			
1929 Barley ..	49·7	at 3s. a bush.	7	9	0	6·5	0	19	6
	Bush.					Bush.			
1930 Peas ..	31·0	at 3s. a bush.	4	13	0	8·3	1	5	0
	Bush.					Bush.			
1931 Rye ..	46·7	at 3s. a bush.	7	0	0	41·8	6	5	6
	T.C.					T.C.			
1932 Potatoes ..	12·0	at £3 a ton.	36	0	0	10·12	31	16	0
	Bush.					Bush.			
1933 Oats ..	67·3	at 2s. a bush.	6	14	6	74·4	7	9	0
	Bush.					Bush.			
1934 Lupins ..	38·2	at 4s. a bush.	7	12	6	38·2	7	12	6
Carried forward ..			102	19	6		61	14	6

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<i>Chalked 5 tons per acre.</i>				<i>Unchalked.</i>			
<i>Winter 1925-6,</i>							
	Bush.		£ s. d.	Bush.	£	s. d.	
Brought forward	102 19 6		61	14	6
1935 Wheat	..	39'3 at 5s. a bush.	9 16 6	31'2	7	16	0
		T.C.					
1936 S. Beet. (Av. of 2 plots)	..	13'8 £2 a ton.	26 16 0	1'12	3	4	0
Total value of crops in 10 yr., per acre	..		139 12 0		72	14	6
Cost of original chalking	2 10 0				
			137 2 0				
Value of unchalked crops	72 14 6				
Increased value per acre of crops in 10 yr. due to chalking, less cost of chalk and excluding value of straw	64 7 6				

Returns obtained by the use of chalk have repaid the original cost more than twenty-five times over in the first ten years.

Sugar-Beet Lime Sludge (Lime Press Cake from Beet Sugar Factories). This waste is produced at beet sugar factories, and some factories allow it to be removed free of charge, or load it up on rail at 1s. per ton. Where the soil is poor in lime it becomes obvious that if this material could be applied to the soil it might prove very valuable. The difficulty is the large, and variable proportion of water it contains, making carriage very heavy. If it is carted after a long period of dry weather the proportion of water is reduced, and of carbonate of lime increased.

As regards the analysis, Mr. F. Hanley, M.A., writes as follows:—"If we assume that the sugar-beet lime sludge has a moisture content of approximately 50 per cent. it might contain about 40 per cent. of carbonate of lime, about 0.8 per cent. of phosphoric acid, about 0.3 per cent. of total nitrogen, and just under 0.1 per cent. of potash. In addition to the above, there is a small quantity of magnesium present, usually amounting to about $\frac{1}{2}$ per cent. oxide of magnesium. There are, of course, traces of iron, aluminium, silica, sulphates, etc., present."

In view of the large weights per acre used, the phosphates, nitrogen and potash are worthy of consideration. If these ingredients are worth half as much per unit as in the common artificial manures, a dressing of 10 tons of sludge per acre would be worth somewhere about 30s. from the point of view of its phosphate, nitrogen and potash content alone.

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Results Obtained in the Field. The sludge has, for some years, been used at certain centres where the soil was acid and for that reason likely to respond to any material containing lime.

(1) In the spring of 1929 an application was given at the rate of 12 tons per acre to portions of a field on the farm of Scots Hall, Westleton, Saxmundham. This field had given very poor crops previously, although generously manured. Roots were grown in 1929, but owing, no doubt, to the late application of the sludge, showed no effect from its use. In 1930 a mixture of oats and barley was drilled on the field. This showed a much larger proportion of barley in the treated area, the crop on the untreated part consisting almost entirely of oats.

This most interesting difference in the crop was undoubtedly because barley is a lime-loving plant, whereas oats can thrive under comparatively acid soil conditions.

Clover and rye-grass were drilled in the corn crop, and owing to a faulty plant this mixture was filled up with trifolium in the autumn. In 1931 the herbage on the untreated part of the field consisted mainly of sorrel, but on the portion treated with sludge there was a very heavy crop of clover.

In 1932 the field was drilled with oats, which were a heavy crop, actually laid, where the sludge had been applied, whereas on the part of the field receiving no sludge, the crop consisted mainly of sorrel and other weeds. As previously noted, oats are not a very sensitive crop to soil acidity, and the superiority of the oats on the treated area must be attributed, in part at any rate, to the heavy crop of clover in the previous year, this having undoubtedly left much valuable root residue and nitrogen, whereas the weedy and unsatisfactory material on the untreated portion was of no value to the succeeding oat crop.

(2) In July, 1930, a dressing of 10 tons of sludge per acre was applied to a 35-acre field at Pannington Hall, Wherstead, Ipswich. Three small areas of approximately $\frac{1}{4}$ -acre each were left untreated, in different parts of the field. This field was one that had not given a satisfactory crop of corn for years, and in one season portions of the crop had been cut and burned, owing to its complete failure and the presence of so many weeds.

The sludge was applied on a seeds mixture consisting mainly of ryegrass—the clover had failed in most parts owing to soil acidity. A first cutting of the seeds was taken. After this,

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in July, the weather was dry, and the motor lorries bringing the sludge took it all over the field and placed it in small heaps ready for spreading, thus avoiding the labour of refilling into carts. The farm is situated about 5 miles from the factory, the charge for haulage being 3s. a ton, so that the total cost was under £2 per acre, including the cost of spreading. The second crop of ryegrass was grazed by sheep, animals that undoubtedly helped to distribute the material all over the ground.

Usually the sludge is of a sticky consistency, and somewhat difficult to distribute. If, however, it is left on the surface of the ground and allowed to dry it becomes very friable. Harrowing then distributes it very effectively.

By 1932 there had been ample time for the material to become incorporated with the soil and the crop was barley, which is very sensitive to soil acidity.

The barley on the major part of the field proved very satisfactory. It became evident in early June that there would be practically no crop on the parts that received no sludge. In spite of two horse-hoeings these patches became covered with weeds—chiefly wild radish, spurrey and a little sorrel. With exactly the same treatment there were comparatively few weeds on the treated parts of the field. At harvest time the untreated parts were a dense mass of weeds with only an occasional ear of barley. If any large area of the field had been in this condition the crop would, of necessity, have been cut and burned before harvest. The lime requirement of soil taken from an untreated area by Mr. F. Hanley, M.A., in 1932, was 39 cwt. of carbonate of lime per acre. Since 1932 every time a crop sensitive to lack of lime has been grown the untreated patches have been conspicuously worse than the rest of the field, and that was so with the 1937 crop (tares and oats).

(3) A third instance was at Tunstall Experimental Station. Here an acre of very acid land was taken in the same field as that in which the previously recorded chalking experiments were conducted, the lime requirement at this end of the field being 33 cwt. of carbonate of lime per acre. In the autumn of 1930, $7\frac{1}{2}$ tons of sugar-beet lime sludge per acre were applied to two-thirds of this, but a strip was left across the middle without treatment.

In 1931 oats were drilled. These were quite a good crop, but distinctly superior where the sludge went. This superiority may have been due to the small quantity of nitrogen present in

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the sludge. They were not harvested separately. A first crop relatively insensitive to soil acidity was selected, as it was recognized that the sludge had not had time to get incorporated with the soil and a complete crop failure was feared.

In 1932 peas were drilled. Peas are very sensitive to soil acidity. Soon after coming above ground the peas on the untreated strip began to assume a sickly appearance. By harvest time they had completely failed, and in spite of hand-hoeing, the land had become covered with spurrey and sorrel. On the area treated with sludge, the peas presented a healthy appearance throughout the season.

The peas and subsequent crops were harvested separately. After 1931 all crops chosen for these plots were purposely selected as relatively sensitive to acidity.

The crops grown in the years mentioned, together with their total value (excluding straw) on sludged and untreated land, are given below; all figures are per acre:—

<i>Sugar-Beet Lime Sludge :</i>									
<i>7½ Tons per acre, Autumn 1930.</i>							<i>No Sludge.</i>		
1931 Oats	A good crop.						A very fair crop.		
	Bush.		£	s.	d.				
1932 Peas	22½ at 3s. a bush.		3	7	6		No crop. Nothing but Sorrel and Spurrey.		
	Bush.		£	s.	d.		Bush.	£	s. d.
1933 Wheat	43·1 at 5s. a bush.		10	15	6		9·3	2	6 6
	Tons. Cwt.						Tons. Cwt.		
1934 Sugar Beet (Washed).									
With F.Y.M.	.. 14 12						1 15		
Without F.Y.M.	14 9						No crop.		
Average ,.	.. 14 10½ at £2 a ton		29	1	0		17½	1	15 0
	Bush.						Bush.		
1935 Barley	42·9 at 3s. a bush.		6	8	6		6·1	0	18 0
	Cwt. of Hay.								
1936 Trifolium	32 at 2s. 6d. a cwt.		4	0	0		No crop. Nothing but Sorrel.		
	Tons.								
Followed by White Turnips									
Wt. of tops and roots (folded by sheep)	16 at 2s. 6d. a ton.		2	0	0		No crop.		
<u>£55 12 6</u>							<u>£4 19 6</u>		

The financial returns obtained from five years crops with sludge cannot properly be compared with those obtained from the chalk in the same field, since specially sensitive crops were

INEXPENSIVE SOURCES OF LIME

planted on the sludge plots, whereas in certain years rye, oats, potatoes and lupins were grown on the chalk plots, these crops not being very sensitive to soil acidity. It seems possible that the lime sludge had not time to get to work properly in the soil for the pea crop of 1932. The importance of applying any form of lime a long time before a sensitive crop is sown cannot be over-estimated.

The three instances mentioned above show that sugar beet lime sludge is a thoroughly satisfactory source of lime, which may be relied upon to give good results if care be taken to ensure uniform distribution. Whether it is the cheapest source of lime depends upon the distance of the farm from the factory, and also from other sources of lime. The proportion of water present in it is too large for it to be carted profitably to any great distance, but within a radius of, say, 20 to 25 miles from a factory, it is quite worth while to compare its relative cost with that of other sources of lime, taking into consideration the cost of carriage. Assuming a dressing of 2 tons of quicklime or 4 tons of carbonate of lime per acre is required, then 8 to 10 tons of the sludge would be needed.

Conclusions. (1) That in considering the question as to which of the various forms of lime are likely to prove most economical, and, over a period of years, the most satisfactory, in any particular district, careful attention should be paid to any cheap and untreated materials (containing lime) that may be available at a reasonable distance, either from natural sources or as waste products. Quite frequently such materials may prove much the cheapest form of lime, when all aspects of the question are considered.

(2) In the experiments above described, both soft lump chalk and sugar-beet lime sludge proved thoroughly satisfactory as a source of lime on an acid soil, and as regards the chalk the original cost was repaid more than twenty-five times over in the first ten years. Equally good results were obtained over a period of five years with sugar-beet lime sludge.

(3) That in order to get the best results from these materials careful attention must be paid to the necessity of leaving them exposed to the weather in order to reduce them to the smallest possible particles. It is also very important to take appropriate means, by harrowing or otherwise, after spreading, to ensure that the whole surface of the ground receives a uniform coat.

AUTUMN LEAVES IN THE GARDEN

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Fallen leaves can probably be best used to make leaf mould, that invaluable aid to the preparation of potting soils. While all leaves will rot to a friable condition in time, some leaves are known to make better leaf mould than others. Oak and beech leaves, for instance, are to be preferred to holly, laurel or privet. Such leaves of evergreens may contain toxic substances injurious to plant life and are better burnt. Leaves collected from road-side heaps may sometimes be contaminated with road tar and should be regarded with suspicion.

When the heap is being made a light sprinkling of lime should be added to each barrow-load of leaves, unless the leaf mould is to be used for the cultivation of rhododendrons or other plants intolerant of lime. The heaps should not be too large or so tightly packed that air is entirely excluded. The best results are usually obtained by slow aerobic decomposition, for which, of course, air in the heap is essential. The most suitable material for potting is obtained from heaps two or three years old.

In heavy soils leaves can also be used with advantage to improve the drainage when trenching is being carried out. The unrotted leaves should be placed at the bottom of the trench, at a depth that can be varied according to the crop to be grown on the land under cultivation, but not so deep as to exclude air. For this purpose some of the leaves less suitable for compost on account of their resistance to decomposition, may be used safely. If leaves are left on the soil surface, earthworms will gradually work them down to augment the supply of humus.

Another way in which old leaves can be helpful is to supply cellulose required to balance the excess of nitrogen in fresh green refuse that is to be used for making compost as substitute for stable manure. As explained in the article on "Composts" in the July issue of this JOURNAL (p. 330), refuse rich in nitrogen, i.e., lawn mowings and fresh weeds, requires to be balanced by sufficient carbohydrate to combine with the nitrogen and so avoid the loss of this element that will otherwise occur. Further, the addition of old leaves to soft green material has two other

AUTUMN LEAVES IN THE GARDEN

advantages. The final product has more body and is usually more effective as an organic manure than the rather sticky residue left by rotted grass-cuttings alone. Also, the latter become too closely packed to allow any air to penetrate the mass, even in quite small heaps or pits, so that an aerobic fermentation develops with the usual unpleasant smells associated with this type of bacterial action on material rich in protein. The addition of old leaves in bulk not greater than that of the fresh green refuse will help to keep the mass open and avoid any nuisance from smell. Besides leaves, any ripe cellulose materials, e.g., herbaceous stalks, can be cut up and used for the same purpose.

When leaves are burnt the ash contains a variable amount of potash and a little phosphate. One hundred pounds of dry oak leaves yield about 5 lb. of ash. This contains 10 oz. of potash (K O) and approximately the same weight of phosphate of lime. If leaves have to be burnt, the ash should be collected and distributed on the soil at once or stored in a dry place until required, as the potash is very soluble in water and easily washed away.

The following table gives the analyses of some of the more useful elements in the ash of various leaves:—

ASH IN CERTAIN LEAVES (WOLFF)						
<i>Per cent.</i>			<i>Per cent. of Ash</i>			
<i>in Dry Leaves</i>			<i>Phosphoric</i>			
		<i>Ash</i>	<i>Lime</i>	<i>Potash</i>	<i>Acid</i>	
Holly	..	4·3	35·7	19·9	5·1	
Fig	..	10·7	38·0	14·9	5·7	
Ivy	..	7·9	26·5	31·6	14·2	
Chestnut	..	4·5	49·5	10·5	8·4	
Acacia	..	11·7	72·0	3·3	1·9	

When leaves are dug in or composted the organic matter and nitrogen, both of which would be lost in the bonfire, can be made to help maintain the supply of humus in the soil. The decomposition of plant residues has been studied extensively in recent years, and it is now possible to predict how material of known analysis is likely to behave when allowed to rot in the soil or compost heap. The three most important constituents controlling the rate of decay are:—

- (1) Easily fermentable carbohydrates (Cellulose and hemicellulose).
- (2) Available nitrogen—if any.
- (3) Lignin.

AUTUMN LEAVES IN THE GARDEN

				(WAKSMAN)	
				<i>Oak Leaves</i>	<i>Pine Needles</i>
					<i>Rye Straw</i>
Cellulose	..	..	17.2	16.4	33.9
Hemi-cellulose	..	..	15.6	19.0	24.8
Lignin	..	..	29.7	22.7	12.4
Nitrogen	..	..	0.6	0.4	0.5
Ash	..	..	6.4	2.5	4.2

In the above table an analysis of rye straw is given for comparison with oak leaves and pine needles. In all three materials the nitrogen present is mainly of a resistant type not easily available to micro-organisms. It will be noticed that in straw the ratio of the easily decomposed cellulose to the very resistant lignin is much higher than in oak leaves and pine needles. Consequently straw rots comparatively quickly when sufficient available nitrogen is added, but the other materials will only decompose slowly even with an extra supply of nitrogen. Leaves will combine with and hold only a fraction of the nitrogen that can economically be added to straw, so that it may not, in practice, be worth while to use more than the sprinkling of lime mentioned above.

THE AMERICAN FARMER COMES TO COLLEGE

J. A. FREEMAN, B.Sc., and

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(Ministry of Agriculture Research Scholars)

In the month of February, when close attention to the farm is not so necessary as at other times in the year, farmers and their families come from all over New York State to Cornell University, at Ithaca, for the Annual Farm and Home Week of the State Colleges of Agriculture and Home Economics. At this time the Colleges are thrown open and the workers there show what is being done to aid the farmer to grow his crops more efficiently and his wife to improve the comfort and beauty of her home.

The Thirtieth Farm and Home Week was held this year from February 15-20, and attracted a record attendance of 11,142 persons, some 3,000 above the last record of 8,000 in 1935. This is an indication of the close co-operation between the scientist and the practical agriculturist, which is so marked a feature of present-day American agriculture. These visitors took away with them about 42,000 bulletins, of which 15,000 were on homemaking and the remainder on various aspects of farm operations. Farm and Home Week is, however, only one phase of the continuous effort being made to assist the farm family in its struggle with Nature. Contact with the scientist is maintained throughout the year by the County Agricultural Agent of the Farm Bureau Organization for the farmer and by the 4-H (Health, Heart, Home, Happiness) Clubs for the younger members of his family.

An account of the activities on the Agricultural Campus during Farm and Home Week should be introduced by stating briefly that the area of New York State is slightly less than that of England, and that fruit, dairy produce and vegetables are the most important agricultural products of the State. The chief problems tackled by the agricultural research workers will thus be primarily concerned with these products.

One of the main problems affecting the American farmer at the present time is that of soil erosion. The mechanical washing away of the top soil of large areas of arable land during heavy rains, by flood waters, is the most urgent problem in New

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York State. Surface denudation, owing to cloud-bursts and violent rainstorms, is the most serious type. An English example of this was seen in Hertfordshire in April, 1936, when torrential rains washed large quantities of top soil from some of the arable fields of the Rothamsted Experimental Station. Gullying and wind erosion are also of importance. It is of interest to note here that wind erosion is rapidly reducing parts of the Middle West to a great dust desert. The destruction of the natural protective covering of vegetation and the conversion of unsuitable land to arable farms have contributed in large measure to the present seriousness of the situation. It has been stated that the annual soil losses from America alone, if loaded in freight cars, would make a train long enough to encircle the equator thirty-seven times! The problem of soil conservation is being attacked by the Federal and State Conservation Services, which give advice to farmers on how to plan their farm layout, how to conserve water, and how to prevent erosion, while they also provide a subsidy towards the maintenance of soil fertility. Much of the actual work of draining, reafforestation and general land improvement is carried out by the Civilian Conservation Corps, a Federal Government Organization. The Corps is recruited voluntarily from unemployed youths taken mainly from the large cities.

At the Farm and Home Week gathering, the Agronomy Department had exhibits showing the results of erosion on the physical and chemical properties of the soil, pictures of soil erosion, and a model of farm layouts showing farms in their original condition and as they are now after reorganization. Soil losses by erosion can be prevented by enhancing soil building by good crop and rotation management, which must be determined in part by the needs of the farmer, the limitations of the soil type and other factors. Lectures and demonstrations were given at various times during the week by soil scientists and officials of the Soil Conservation Service.

In certain parts of New York State, agriculture is on the decline, a result of the depression, which has made the farming of poor or submarginal land an unprofitable occupation. The Rural Resettlement Administration, a department of the Federal Government, is buying farms in poor areas and resettling their occupants in farms on better soil. Scientific studies form the basis of this operation. The Agricultural Economist, in his studies of prices and economic conditions generally, has



The Agricultural Economics Building of the New York State College of Agriculture, Cornell University
Photograph Copyright by I. W. Selman

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shown when and why certain types of farming are unlikely to pay. In co-operation with the forester he has shown that the re-forestation of the submarginal land is the best possible use that can be made of it. The Agricultural Economics Department has made a study of New York State, county by county, and has outlined electrification and hard road programmes based on a land classification. Thus the planning of rural electrification projects and road building schemes can be directed into the fertile "muck lands" and useless expenditure prevented in areas which must soon become agriculturally derelict. There is also another Federal Service, the Rural Electrification Administration, which makes loans to farmers to aid them in electrifying their farms on a co-operative basis, thus bringing electrical power within the reach of the majority of New York farmers. All these matters are dealt with at the Farm and Home Week.

The protection of crops from natural enemies, animal and plant, is the concern of the Departments of Entomology and Plant Pathology. The Entomology Department exhibited the results of research on the control of noxious insects. Potato pests have been the subject of much research, special attention being directed to leaf hoppers, flea beetles, tarnished plant bugs, aphides, cutworms, wireworms and the Colorado beetle. Other exhibits showed the results of work on the Onion Thrips, which may be best controlled by the use of resistant varieties of onions, and on the Alfalfa (lucerne) Snout Beetle, which, introduced from Europe, has recently been doing considerable damage in a limited area near Oswego. Of the fruit pests, the Codling Moth and the Apple Maggot are the most important. Methods similar to those used in Europe are employed against these pests, but investigators are trying to find less expensive methods of control. The Dutch Elm disease, believed to have been introduced from Europe, is prevalent in an area of about fifty miles radius from New York City and is slowly spreading. There is at present no remedy other than the destruction of infested trees. The study of the problem is a co-operative project of the Departments of Entomology and Plant Pathology and of the Federal Government Laboratory situated in New Jersey. This combined effort is necessary, since the disease is caused by a fungus which is carried from tree to tree by a bark beetle.

The Plant Pathology Department also showed the farmer the organisms causing Apple Scab, Potato Blight and grain smuts, by means of laboratory lessons of about an hour's duration,

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during which the visitor might gain some knowledge of life histories and control measures. A "Spray-Service-Trouble Hour," conducted by experts of the Entomology and Plant Pathology Departments, enabled individual farmers to obtain expert advice on their own immediate problems.

An extensive show of bees, beekeeping equipment and honey was displayed in the Apiculture Section. The honey is largely of two types, clover and buckwheat, and new treatments have been evolved making it possible to produce a very fine-grained, crystalline honey. The use of beeswax in the production of high-grade candles was another recent development.

Of the fifty varieties of apples exhibited by the Pomology Department, the most popular were "Macintosh"—a fine red dessert apple—and "Northern Spy"—for dessert and cooking. The importance of light for the production of red pigments was demonstrated, and the predominance of glossy, red fruit was an index of the way in which the growers aim to produce a fruit that appeals to the eye of the buyer. The Pomology Department, amongst other projects, was attempting the introduction of Cox's Orange Pippin.

In the Poultry Department, living chick embryos of different ages were exhibited by means of a glass-topped incubator containing the eggs, the tops of which had been chipped away to expose the embryos. Vitamin and mineral deficiency symptoms were demonstrated in living chickens.

Exhibits in the College of Home Economics covered all the household activities, and for choosing bedding, mending clothes, selecting library books, planning economical meals, concocting new dishes, appreciating modern methods of illumination and keeping fit, the New York State farmer's wife should be a very paragon of domestic virtues.

In addition to many lectures on specific subjects, there were demonstrations of general interest in Bailey Hall, a University theatre seating 2,000 people. Every day from noon to one o'clock, students of the Home Economics College acted as mannequins in a fashion show, presenting bright clothes and ideas on dressmaking directly to the farm family. Following this was a film show lasting about an hour. The most interesting picture shown was the Federal Government's Film, "The Plough that Broke the Plains." This describes the destruction of a vast, natural grazing region by the growing of grain, a process which was accelerated by the demand for wheat during the Great War. The destruction of natural

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cover, together with a succession of dry years, has led to unprecedented wind erosion in the Great Plains Area.

Two of the great attractions of Farm and Home Week were the visits of Mrs. Roosevelt and Governor Lehman. Mrs. Roosevelt spoke to a packed house of about 2,000 on "A Day in the White House," which gave one some idea of the strenuous activities of the wife of the President of the United States. The address of Governor Lehman was mainly concerned with the current problems affecting the milk supply of the State. At present the price of milk is controlled by a Milk Control Board, run on lines similar to our own Milk Marketing Board. The main difficulty here, as elsewhere, would appear to be that the dairymen cannot agree amongst themselves as to the best policy to pursue on questions of general co-operation, price fixing, transport and other problems. In his speech Governor Lehman emphasized the value placed on research by the authorities and gave an assurance of his continued support.

Three events, more reminiscent of an English agricultural show, proved extremely popular. These were a Cornell students' livestock show, a contest between horse-teams to find the best drawbar pull as measured by a special dynamometer car, and a State woodchopping contest in which the winner severed an eight-inch beech log in twenty-eight seconds.

Apart from the sub-marginal lands referred to above, New York State is one of the most fertile and extensively farmed states in the Union and much of its agricultural prosperity is surely due to its readiness to maintain its research and extension service at a high level of operation. The attitude of the agriculture research scientist at Cornell and Geneva (N.Y.) is simply stated in a popular bulletin distributed by the Agronomy Department and may well apply to all departments: "The Agronomy Department is a collection of good-natured persons who are supposed to have some knowledge of the sciences relating to soils and field crops, and even to know something about soil management and crop production. These good-natured persons are at your service—use them during Farm and Home Week." The genuine interest and enthusiasm of the farmers, so manifest during this Farm and Home Week, would suggest that closer co-operation than hitherto, between farmer and scientist, in England, might be of value to all.

LIVE STOCK IMPROVEMENT:

REPORT FOR THE YEAR ENDED MARCH 31, 1937

This Report deals with the Ministry's activities, statutory and administrative, in regard to the improvement of live stock. The former include the exercise of powers contained in the Horse Breeding Act, 1918, as regards the licensing of stallions, and in the Improvement of Live Stock (Licensing of Bulls) Act, 1931.

Apart from these statutory functions, the Ministry administers a Scheme for the Improvement of Live Stock, the main object of which is to direct the attention of farmers, especially the smaller farmers, to the value of using pedigree sires for grading up their farm stock, and of keeping records of the milk yield of their cows with the object of getting rid of poor milkers, obtaining information for economic rationing, and generally improving, by judicious selection, the productiveness of their herds. Under the Scheme, grants are awarded by the Ministry to enable farmers to obtain, at reasonable service fees, the use of pedigree bulls and boars that have been approved by the Ministry's Live Stock Officers; a few grants for the improvement of Welsh Mountain sheep are also provided. As regards heavy horses, grants or premiums—direct and by way of assisted nominations—are made to Societies in connexion with the hiring of stallions. In addition, grants are made to Societies whose members record the milk yield of their cows.

General Remarks. There was no outstanding change in the conditions ruling in the livestock industry during the year under review. The subsidy paid under the Cattle Industry (Emergency Provisions) Acts improved the returns from the marketing of fat cattle, and this to some extent checked the tendency to favour milk production at the expense of stock-rearing, to which reference was made last year. It is anticipated that a further check will be provided by the quality subsidy for cattle that will be paid under the Livestock Industry Act, 1937. The location of premium bulls under the Live Stock Improvement Scheme, however, continued to be difficult for the reasons given later in this report.

So far as the pig industry was concerned, the chief feature

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of the year was the breakdown of the marketing arrangements for bacon pigs. The resulting uncertainty, combined with the high prices of feeding stuffs, caused many farmers to make reductions in the numbers of pigs kept both for breeding and feeding purposes. This was reflected in a decreased demand for the location of premium boars in some districts during the year.

Grants made to Heavy Horse Societies continued to be much appreciated by farmers and the use of stallions hired by these Societies increased during the year.

The number of farmers who are members of Milk Recording Societies also showed a further slight rise, but in this connexion there is room for considerable expansion.

The arrangements for the licensing of bulls continued to operate smoothly. Very many farmers are brought into direct contact with officials of the Department, as a result of the visits of the Live Stock Officers to inspect their bulls, and the absence of any serious criticism of the manner in which the Minister's powers are exercised may be taken as an indication that the compulsory licensing of bulls is now accepted by the farming community as a measure of general benefit to the live stock branch of the agricultural industry.

Licensing of Bulls. Table I gives particulars of the number of applications for bull licences dealt with during the twelve months ended March 31, 1937, and the comparative figures for the previous twelve months.

TABLE I.—LICENSING OF BULLS

	<i>Twelve months ended March 31, 1936</i>	<i>Twelve months ended March 31, 1937</i>
Applications for Licences received	38,426	43,722
Licences issued	31,969	37,848
Rejections notified	4,690	6,663
Permits issued	53	72
Licences suspended	32 (a)	31 (a)
Licences transferred	21,408	33,673
Appeals to referees received ..	285	567
Appeals to referees dealt with ..	269 (b)	540 (c)

(a) Licences suspended pending recovery of the bulls from temporary forms of disease (mainly ringworm).

(b) Of these 138 were decided in favour of the appellant, while in 131 cases the Ministry's decision was confirmed.

(c) Of these 299 were decided in favour of the appellant, while in 241 cases the Ministry's decision was confirmed.

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An examination of the table shows that in 1936-37 there was a further substantial increase in the number of applications for licences as compared with the previous year, and that there was an increase of nearly 2,000 in the number of bulls rejected as unsuitable for licensing, the proportion amounting to 14.9 per cent., of the number examined, as compared with 12.8 per cent. in 1935-36. When considering the greater numbers of rejected bulls it must be borne in mind that the Ministry's standard is now higher than it was during the earlier period of licensing. The policy of gradually raising the standard that bulls must attain to be licensed, is one that the Ministry has reason to believe meets with the approval of the farming community, and in fact the opinion has been expressed in some quarters that an even higher standard is desirable than that now in force. In this connexion it is of interest to note that according to the Agricultural Returns the number of bulls used for service in England and Wales in 1937 was 86,423 as compared with 83,781 in 1936 and 85,850 in 1935. These figures should tend to allay any fears that licensing has resulted in a shortage of bulls in the country.

There is undoubtedly an improvement in the class of bull submitted for licence, not only as regards conformation but also in condition and general appearance. The improvement, however, is not so pronounced in dairy herds where there is a tendency for farmers to keep bulls solely on account of the milking capacity of their dams without regard to type, conformation or breeding.

The Ministry is satisfied that instances of deliberate evasion of the requirements of the Act are comparatively few, and that farmers, generally, are appreciating the benefits that accrue from bull licensing. Many owners, however, still do not realize that an application for a licence should be made 28 days before the bull attains the age of 10 months.

The number of permits issued was 72, practically all of which were granted to owners of monorchids who desired to keep the animals for a limited period until they were in a suitable condition for slaughter.

The most noticeable increase during the year was in the number of licences transferred on change of ownership; during the 12 months ended March 31 last, the number of transfers was only 4,000 less than the number of new licences issued. Despite the extent to which bulls are bought and sold many

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farmers do not realize that a licence issued to a former owner becomes void if it is not forwarded to the Ministry for transfer within one month of its receipt by the new owner of the bull.

Figures showing the number of bulls licensed and rejected in each county in England and Wales are given in Table II. As explained in previous years, these figures must not be used to draw deductions as to the parts of the country in which the best class of stock is to be found. There is, however, some evidence that in the counties showing the greatest percentage of rejected bulls, the animals of low standard are largely found in semi-urban environment where the primary consideration is the production of milk and not the breeding of cattle.

TABLE II.—PARTICULARS OF BULLS LICENSED AND REJECTED IN EACH COUNTY IN ENGLAND AND WALES FOR THE TWELVE MONTHS ENDED MARCH 31, 1937.

County	Licensed	Rejected	County	Licensed	Rejected
ENGLAND --			Suffolk	490	145
Bedfordshire ..	192	35	Surrey	393	29
Berkshire	545	58	Sussex	951	73
Buckinghamshire ..	558	60	Warwickshire ..	537	125
Cambridgeshire ..	242	49	Westmorland ..	1,031	78
Cheshire	1,292	349	Wiltshire	1,293	152
Cornwall	755	51	Worcestershire ..	309	83
Cumberland	2,010	317	Yorkshire	4,047	670
Derbyshire	1,138	186			
Devonshire	317	103	TOTAL—ENGLAND	33,555	5,691
Dorset	923	159			
Durham	941	89	WALES AND MON-		
Essex	692	135	NOUTH--		
Gloucestershire ..	720	134	Anglesey	54	20
Hampshire	906	140	Brecon	249	44
Herefordshire ..	813	86	Caernarvon	207	48
Hertfordshire ..	385	27	Cardigan	403	64
Huntingdonshire ..	79	7	Carmarthen	1,191	252
Isle of Wight ..	215	15	Denbigh	570	156
Kent	493	42	Flint	407	77
Lancashire	1,940	553	Glamorgan	198	91
Leicestershire ..	664	84	Merioneth	191	27
Lincolnshire	984	113	Monmouth	233	36
Middlesex	18	12	Montgomery	202	80
Norfolk	604	187	Pembroke	248	56
Northamptonshire	304	47	Radnor	80	21
Northumberland ..	643	105			
Nottinghamshire ..	229	76	TOTAL—WALES AND		
Oxfordshire	462	59	MONMOUTH	4,293	972
Rutland	48	7			
Shropshire	1,054	372	TOTAL ENGLAND		
Somerset	1,586	342	AND WALES	37,848	6,663
Staffordshire	1,253	337			

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Table III shows the number of bulls licensed and rejected for each breed, with comparative figures for the previous twelve months. These figures indicate that the percentage of rejections was greater for almost all the breeds. The rejections of cross-bred bulls amounted to 87 per cent. of the number examined.

In connexion with the figures shown in this table it should be explained that the bulls included under any particular breed are not necessarily pedigree or pure bred, but include all bulls in which the characteristics of that particular breed are predominant.

TABLE III.—PARTICULARS BY BREEDS OF BULLS LICENSED AND REJECTED.

	Twelve months ended March 31, 1936		Twelve months ended March 31, 1937	
	Licensed	Rejected	Licensed	Rejected
Aberdeen Angus ..	851	57	760	61
Ayrshire	296	30	445	67
Blue Albion	44	6	48	10
British Friesian ..	2,010	187	2,502	314
Devon	1,037	77	1,031	134
Dexter	24	—	35	1
Dun and Belted Gal- loway	3	1	10	—
Galloway	272	26	289	34
Gloucestershire ..	6	1	7	3
Guernsey	1,515	60	1,882	111
Hereford	1,878	284	2,194	404
Highland	4	—	4	—
Jersey	478	27	613	27
Kerry	21	—	19	1
Lincoln Red Shorthorn	1,438	139	1,604	204
Longhorn	3	—	8	—
Park	16	1	10	2
Red Poll	575	108	623	117
Shorthorn	20,231	2,621	24,600	3,990
South Devon	424	21	423	33
Sussex	179	11	189	14
Welsh Black	386	22	393	68
Cross-bred	278	1,011	159	1,068
TOTAL	31,969	4,690	37,848	6,663

During the year under review, proceedings were instituted against bull-owners in 113 instances for keeping bulls without licences after they had reached the age of ten months. It was also necessary to prosecute in 9 cases for failure to comply with the order requiring castration or slaughter of rejected

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bulls, or for the movement of rejected bulls otherwise than to a slaughterhouse for the purpose of slaughter. Fines ranging from 2s. 6d. to £5 were imposed in 100 instances, while 19 were dismissed on payment of costs.

Licensing of Stallions.* The number of stallions licensed under the Horse Breeding Act, 1918, in England and Wales for the 1937 service season was 2,108. This represents an increase of 58 or 2.8 per cent. on the previous year and is the highest number recorded since 1924. During the past six years a steady increase has been maintained, and the number of stallions licensed in 1937 shows an increase of 47.2 per cent. on the figure for the 1931 season.

TABLE IV.—LICENSING OF STALLIONS

<i>Year (ending October 31)</i>		<i>No. of Applications for Licences</i>	<i>No. of Licences issued</i>	<i>No. of Refusals</i>
1920	.. ..	4,153	3,749	404
1921	.. ..	4,060	3,816	244
1922	.. ..	3,644	3,479	165
1923	.. ..	2,897	2,761	136
1924	.. ..	2,285	2,210	75
1925	.. ..	1,908	1,849	59
1926	.. ..	1,664	1,608	56
1927	.. ..	1,574	1,537	37
1928	.. ..	1,454	1,414	40
1929	.. ..	1,472	1,436	36
1930	.. ..	1,472	1,430	42
1931	.. ..	1,470	1,432	38
1932	.. ..	1,522	1,477	45
1933	.. ..	1,556	1,516	40
1934	.. ..	1,732	1,687	45
1935	.. ..	1,945	1,893	52
1936	.. ..	2,124	2,050	74
1937	.. ..	2,172	2,108	64

Heavy stallions were wholly responsible for the increase, 1,856 being licensed during the year under review as against 1,775 licensed in the previous year, an increase of 4.5 per cent. Numerically, Shires again showed the greatest increase, rising from 1,188 in 1936 to 1,233 in 1937, an increase of 45 (3.8 per cent.). The other heavy breeds, however, showed relatively larger increases, Percherons rising by 12 (12.1 per cent.),

* This section of the Report covers the travelling season for 1937. No applications for licences are considered after July 31 in any year and licences expire on October 31. For particulars of the 1936 season reference should be made to the article on this subject in the JOURNAL for December, 1936.

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Suffolks by 18 (8 per cent.) and Clydesdales by 13 (6.8 per cent), as compared with the figures for 1936. The number of licences granted in respect of light stallions showed an appreciable decrease, 178 stallions being licensed in 1937 as against 198 in 1936, a decrease of 10.1 per cent. This was mainly attributable to the decrease of 14 (8.5 per cent.) in the number of Thoroughbreds licensed. Ponies and Cobs remained practically unchanged, 74 licences being granted in 1937 in respect of these stallions as compared with 77 in the previous year.

TABLE V.—NUMBERS OF LICENCES GRANTED UNDER THE HORSE BREEDING ACT, 1918, IN ENGLAND AND WALES, 1936 AND 1937

BREED OR TYPE	Pedigree (i.e., Stallions entered or accepted for entry in the recognized Stud Book of their Breed).		Non-Pedigree (i.e., Stallions not entered or accepted for entry in a recognized Stud Book)		Totals of each Breed and Type (Pedi- gree and Non-Pedigree)	
	1936	1937	1936	1937	1936	1937
HEAVY						
Shire	1,018	1,075	170	158	1,188	1,233
Clydesdale ..	165	174	26	30	191	204
Suffolk	221	240	5	4	226	244
Percheron ..	94	105	5	6	99	111
Others	—	—	71	64	71	64
Total Heavy Horses	1,498	1,594	277	262	1,775	1,856
LIGHT						
Hackney	9	6	5	5	14	11
Thoroughbred ..	100	147	4	3	104	150
Arab	8	10	2	1	10	11
Others	4	3	6	3	10	6
Total Light Horses	181	166	17	12	198	178
PONIES AND COBS						
Welsh	8	4	1	3	9	7
Fell	5	6	1	1	6	7
Dales	9	8	7	2	16	10
Polo and Riding ..	7	9	1	3	8	12
Welsh Cob	15	18	15	18	30	36
Others	8	2	—	—	8	2
Total Ponies and Cobs	52	47	25	27	77	74
TOTALS	1,731	1,807	319	301	2,050	2,108

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The number of cases in which licences were refused showed a decrease of ten, 64 stallions being refused in 1937 as compared with 74 refusals in 1936. The decrease is mainly due to the reduction in the number refused because of defective physique and conformation. Only 5 were refused for this defect in 1937, as compared with 13 the previous year, and this is an indication that stallion owners are now submitting a better class of horse for licensing. In 11 instances appeals against refusals were lodged, and 4 of these were successful, as against 13 appeals, of which 8 were successful, recorded in 1936. The breeds of the rejected stallions and the reasons for rejection are set out in Table VI.

TABLE VI.—NUMBER OF APPLICATIONS FOR LICENCES NOT GRANTED AND
GROUNDS FOR REFUSAL, 1937

Breed	Number refused	Percentage refused	Diseases									
			Whistling	Roaring	Sidebone	Cataract	Shivering	Ringbone	Bone Spavin	Defective Genital Organs	Poor Physique and Conformation	Stringhalt
PEDIGREE :												
Thoroughbred ..	6	3.9	1 (a)	1	—	1	—	—	1	2	—	—
Shetland Pony ..	1	50.0	—	—	—	1	—	—	—	—	—	—
Welsh Cob ..	1	5.3	—	—	—	—	—	—	—	—	—	1
Clydesdale ..	4	2.2	—	—	3	—	—	—	1	—	—	—
Percheron ..	1	0.9	—	—	1	—	—	—	—	—	—	—
Shire ..	33	3.0	11	7	9	—	1	1	—	—	2	2
Suffolk ..	6	2.4	1	—	2	1	1	—	—	—	1	—
NON - PEDIGREE :												
Cob ..	1	5.3	—	—	—	—	—	—	—	—	1	—
Heavy ..	11	4.0	2	2	2	1	1	1	—	1	1	—
TOTALS ..	64	2.9	15	10	17	4	3	2	2	3	5	3

(a) Also affected with roaring.

The number of infringements of the Act reported to the Ministry during the season was 59, an increase of 12 on the number reported in the previous season. In two instances proceedings were taken by the police in respect of the travelling of unlicensed stallions; in one of these a conviction was recorded and the other was dismissed. Most of the other infringements reported were in respect of the travelling or exhibi-

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ting for service of licensed stallions unaccompanied by their licences, and the owners and leaders of the stallions were warned by the Ministry or police as to the requirements of the Act in this respect.

Premium Bulls. Reports from the Ministry's Live Stock Officers indicate that the turnover to milk production has been arrested, to some extent, by the better prices obtained for cattle, combined with the fact that milk has been less remunerative owing to the higher prices of feeding stuffs. The higher rates of subsidy offered for home-bred than for imported cattle under the Livestock Industry Act, 1937, together with the shortage of good class stores, should help to improve returns further and put stock rearing on a more satisfactory basis. The provision in the Act for the payment of a higher rate of subsidy in respect of the best quality fat cattle should prove an incentive to the improvement of quality. The farmer who rears stores for the market will doubtless realize that, if he is to reap the full benefit from the revised subsidy arrangements, he must produce the type of cattle likely to obtain the " quality " subsidy. Breeders who have been using good pedigree sires of carefully selected type should benefit by obtaining increased prices for their store and fat cattle.

Owing to the increased value of stores, the practice of selling all the milk and not rearing any calves has been modified slightly, and some dairy farmers are now rearing their best calves, although large numbers are still sold in the markets for immediate slaughter. Many good class heifers that would ordinarily have found their way into the dairy herds have been slaughtered in order to obtain the subsidy, but this is unlikely to continue owing to the high prices that the dairy farmer now has to pay for dairy cows to replenish his herd, and the strong market for down-calving heifers. Despite the tendency in some rearing districts to revert to the breeding and rearing of stores, there are still many farms now producing milk that were formerly used for stock raising and that are not always very suitable for milk production owing to lack of adequate buildings.

Farmers, on turning to milk production, usually cease to pay much attention to the breeding of good class cattle, and indiscriminate crossing, to which attention has been called in recent reports, is stated to be practised in all parts of the country with unfortunate results in so far as the stock is con-

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cerned. In one district in South Wales it is reported that it is very difficult to find a herd of cows of only one breed.

The higher rate of subsidy payable for best quality fat cattle should encourage the use of the dual-purpose type of bull. Difficulty, however, is often experienced in obtaining bulls of the required type. Reference was made in the report for 1935-36 to the keen demand that exists for bulls that have completed their period of service under the Scheme, and in some districts in Wales practically all the premium bulls that have not become too heavy for use have been bought for private herds; some of the best are now used as stock bulls in pedigree herds. This movement is encouraged as it is felt that these sires, which have proved their value, should be retained for breeding purposes as long as possible.

TABLE VII.—NUMBER OF BULLS SUBSIDIZED EACH YEAR SINCE THE COMMENCEMENT OF THE SCHEME

<i>Year</i> (April 1—March 31)	<i>No of</i> <i>Bulls</i>	<i>Year</i> (April 1—March 31)	<i>No. of</i> <i>Bulls</i>
1914-15 ..	497	1926-27 ..	1,287
1915-16 ..	633	1927-28 ..	1,372
1916-17 ..	659	1928-29 ..	1,408
1917-18 ..	710	1929-30 ..	1,476
1918-19 ..	721	1930-31 ..	1,537
1919-20 ..	675	1931-32 ..	1,494
1920-21 ..	668	1932-33 ..	1,452
1921-22 ..	847	1933-34 ..	1,469
1922-23 ..	947	1934-35 ..	1,476
1923-24 ..	978	1935-36 ..	1,469
1924-25 ..	1,069	1936-37 ..	1,447
1925-26 ..	1,175		

Factors adversely affecting the distribution of premium bulls under the Scheme were set out in last year's report, and may be summarized as follows:—

- (1) Change over to milk production.
- (2) A tendency on the part of farmers to think that any licensed bull is good enough, whereas generally the standard of a bull that has been selected for a premium under the Scheme is much higher than that which, at the present time, is necessary to enable a licence to be obtained.
- (3) Initial outlay involved in the purchase of a premium bull.
- (4) Farmers keeping their own bulls owing to (a) increase in size of dairy herds, (b) difficulty of driving cows for service owing to road traffic.

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To (4) must now be added a definite labour shortage in districts near big centres of population, which makes it increasingly difficult to spare men to drive the cows for service. In all the circumstances it is not surprising that on March 31, 1937, the number of premium bulls had somewhat decreased to 1,447, as compared with 1,469 on March 31, 1936. The total number of cows served during the year 1936-37, however, increased to 98,156 cows, belonging to 22,768 owners, as compared with 96,827 cows belonging to 22,634 owners in 1935-36. The average number of services per bull was 68, as compared with 67 in the previous year.

The schemes for the marking of the progeny of premium bulls have been continued during the year. The number of animals marked by the Bletchley & District Livestock Improvement Society during the year was 103. The Staffordshire schemes have not made the progress anticipated, but it is hoped that in view of the greater interest now taken in rearing, more premium bull societies will take up the scheme in future.

The marking scheme started by the Shropshire Livestock Improvement Association, which has been in operation for a little over a year, is not at present receiving the support that it deserves.

The aims and objects of the Welsh Dragon Mark Association were set out in the report for 1935-36. The progeny of premium bulls and other approved pedigree sires in Brecon, Radnor and Monmouth are tattooed with the Association's mark and sales are arranged from time to time at which only marked store cattle are entered. As a result of extensive propaganda undertaken by the Welsh Agricultural Organization Society (who have managed the Association since 1934) large numbers of feeders from the fattening districts in the Midlands have attended these sales of marked cattle and enhanced prices have been realized by the breeders.

The South Wales Cattle Breeders' Association was formed at a representative meeting of Shorthorn Breeders from the counties of Cardigan, Carmarthen and Pembroke held at Carmarthen in the autumn of 1935. The object of the Association was the organization of sales of pedigree stock (chiefly bulls) under its own auspices at Carmarthen, to attract English buyers and extend the Association's sphere of influence.

Four sales have been held at two-monthly intervals each winter since the formation of the Association and there is no

doubt that there has been a keener demand for bulls and that the standard has been more uniform. Improved prices have been realized and an interesting feature has been the success of the progeny of premium bulls at the sales. At the November, 1936, sale, the two top-priced bulls were the progeny of premium bulls. Fourteen bulls were bought at this sale for use under the Scheme.

The standard of premium bulls has been well maintained and premium bulls and their progeny continue to do well at the sales and shows.

A premium Lincoln Red Shorthorn was first in open classes at Leicester, Lincoln and Peterborough, and of 3 yearling bulls, the progeny of another premium Lincoln Red Shorthorn in the same district, one won a first and special prize for the best Lincoln Red Shorthorn in the sale at Leicester and realized 42 guineas, the second sold at Lincoln for 43 guineas, and the third at Leicester for 36 guineas. In an adjoining district a non-pedigree Lincoln Red Shorthorn bull, sired by a premium bull, sold at 11 months for 42 guineas. The dam and grand-dam of the bull were also sired by premium bulls. Four Devon bulls, the progeny of premium bulls, fetched 83, 65, 54 and 50 guineas respectively at Exeter; and a premium bull of the same breed won a first prize and the Challenge Cup in the Devon County Show. The progeny of premium bulls won 4 first and 3 second prizes at the Royal Cornwall Show.

The championship for Shorthorn bulls at the Royal Welsh Show was won by the same premium bull as was successful in the previous year, while a premium Hereford bull also won a first prize and the championship of its breed at this show and a first at the Bath and West Show. The bull was sold for 300 guineas for export to the Argentine. A yearling Hereford bull of which the sire and the dam's sire were premium bulls was sold for £700 for export to the Argentine.

The champion South Devon bull at the Royal Show had served for the full period under the Scheme as a premium bull, and several prizes were won in the Welsh Black classes at the Royal Welsh Show by premium bulls and by animals sired by a premium bull.

Breeds and Prices. The average price paid for subsidized bulls rose from £40 6s. 11d. in 1935-36 to £42 1s. 7d. This is the highest price recorded since 1932-33.

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TABLE VIII.—NUMBER AND AVERAGE PRICES OF PREMIUM BULLS

BREED	1934-35		1935-36		1936-37	
	No.	Average price	No.	Average price	No.	Average price
Aberdeen Angus ..	7	£ 36 9 10	5	£ 39 5 5	4	£ 39 18 0
British Friesian ..	5	49 3 2	6	49 6 0	8	51 4 6
Devon	200	46 17 4	202	46 7 3	205	48 7 5
Galloway	3	27 6 0	3	27 6 0	3	24 16 4
Guernsey	31	39 4 7	29	39 2 10	25	42 13 2
Hereford	213	39 7 3	218	39 15 5	229	42 10 3
Lincoln Red Short-horn	157	39 1 5	157	39 4 7	153	41 0 3
Red Poll	1	36 15 0	1	31 10 0	1	52 10 0
Shorthorn	759	41 4 9	750	40 12 2	718	42 1 0
South Devon ..	15	42 15 3	14	40 4 5	16	42 8 6
Sussex	9	34 8 5	7	31 14 5	6	31 19 0
Welsh Black ..	76	27 19 4	77	27 2 11	79	27 1 5
All Breeds	1,476	40 14 5	1,469	40 6 11	1,447	42 1 7

Approximately half of the bulls subsidized are Shorthorn, but the number of Dairy Shorthorns has decreased from 536 in 1935-36 to 511 in the year under review. In the same period the number of purely dairy bulls has decreased from 571 to 544, whilst the number of beef and dual-purpose bulls has increased by 5.

Service Fees. The service fees charged for the use of premium bulls during the past three years are as follows:—

SERVICE FEES—BULLS									
Year	2/6	3/-	3/6	3/9	4/-	4/6	5/-	5/6	6/-
1934-35 ..	95	48	61	1	173	20	833	9	108
1935-36 ..	93	57	60	1	179	21	831	8	99
1936-37 ..	94	60	68	—	193	15	796	9	101
Year	6/6	7/-	7/6	8/-	10/-	10/6			
1934-35 ..	11	5	103	4	5	—			
1935-36 ..	11	4	100	2	2	1			
1936-37 ..	10	4	93	2	1	1			

The tendency towards lower fees referred to in recent years continues: 5s. is still the popular fee, but the number of fees below 5s. increased from 411 in 1935-36 to 430.

Premium Boars. Pig keepers are taking much more interest in the class of pigs they breed, and reports received by the Ministry show that the standard of boars used is much higher than it was a few years ago.

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This improvement is largely due to the Pigs Marketing Scheme, which made it worth while for producers to adopt better methods of selection, breeding and rationing, and encouraged pedigree-pig breeding to come more in line with commercial requirements.

The high price of feeding stuffs, and the uncertainty as to the future marketing arrangements, however, resulted in the sale for slaughter of many gilts and sows that would normally have been kept for breeding purposes. The price of feeding stuffs made pig keeping less profitable for the small man, and the tendency noted in the report on the Scheme for 1935-36, for the cottager and labourer to give up pig keeping, continues.

Under present conditions, there is not so much demand for the use of premium boars, and the number subsidized under the Scheme had fallen on March 31, 1937, to 1,013, as compared with 1,029 a year previously.

TABLE IX.—NUMBER OF BOARS SUBSIDIZED EACH YEAR SINCE THE COMMENCEMENT OF THE SCHEME

<i>Year</i> (April 1—March 31)	<i>No. of</i> <i>Boars</i>	<i>Year</i> (April 1—March 31)	<i>No. of</i> <i>Boars</i>
1914-15 ..	115	1926-27 ..	844
1915-16 ..	193	1927-28 ..	907
1916-17 ..	216	1928-29 ..	933
1917-18 ..	264	1929-30 ..	972
1918-19 ..	350	1930-31 ..	1,047
1919-20 ..	399	1931-32 ..	1,024
1920-21 ..	441	1932-33 ..	973
1921-22 ..	550	1933-34 ..	1,007
1922-23 ..	569	1934-35 ..	1,032
1923-24 ..	638	1935-36 ..	1,029
1924-25 ..	655	1936-37 ..	1,013
1925-26 ..	710		

The total number of services decreased from 65,699 in 1935-36 to 60,013 in 1936-37, and the number of persons sending sows to the boars also declined from 25,178 to 22,295.

The average number of services per boar in 1936-37 was 60 compared with 65 in the previous year.

Breeds and Prices. The number and average prices of boars of each of the breeds subsidized for the past three years are shown in the following table.

Average prices show on the whole practically no change on the year. Large White boars retain their popularity and now total 95 per cent. of the boars subsidized under the Scheme. Of the 226 premium boars in Wales, 194 are Large Whites, 27 Welsh and 5 Long White Lop-eared. During the year

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TABLE X.—NUMBER AND AVERAGE PRICES OF BOARS OF EACH BREED.

BREED	1934-35			1935-36			1936-37					
	No.	Average price			No.	Average price			No.	Average price		
		£	s.	d.		£	s.	d.		£	s.	d.
Berkshire	2	13	13	0	1	15	15	0	1	15	15	0
Cumberland	2	8	14	0	2	7	7	3	1	11	0	0
Essex	1	10	10	0	1	8	0	0	1	8	0	0
Large Black	5	11	9	2	3	10	6	8	3	10	6	8
Large White	969	10	19	0	970	10	18	0	964	10	18	0
Long White Lop-eared	16	11	13	11	10	10	13	7	8	11	1	2
Middle White	11	9	4	6	8	10	7	8	6	9	14	4
Wessex Saddle-back	2	11	11	0	1	13	13	0	2	8	18	6
Welsh	24	11	13	5	33	11	8	10	27	11	18	5
All Breeds	1,032	10	19	3	1,029	10	18	2	1,013	10	18	4

under review, 102 new grants were approved in England and Wales, and 96 of these related to Large White boars.

Service Fees. The following table shows the service fees charged during the past three years:—

SERVICE FEES—BOARS

Year	2/6	3/-	3/6	4/-	4/6	5/-	5/6
1934-35 ..	2	11	21	99	7	763	2
1935-36 ..	4	13	23	97	6	772	2
1936-37 ..	7	14	28	100	11	751	—

Year	6/-	6/6	7/-	7/6	8/-	10/-
1934-35 ..	71	2	1	50	1	2
1935-36 ..	61	1	2	46	1	1
1936-37 ..	58	1	2	39	1	1

Service fees continued to show a tendency to decline, and 90 per cent. of the fees charged are now 5s. or under.

Premium Rams. Thirty grants for Welsh Mountain Rams were again available for the 1936 season, and all were utilized. The hiring fees ranged from £6 to £12, and service fees from 1s. to 3s. 27 of the rams were hired at £10 or over. During the 1936 season 1,808 ewes were sent for service under the scheme, an average of 60 ewes per ram.

Horse Breeding : Heavy Horse Grants. The improvement in the trade for horses noted in the report on the Scheme for 1935-36 has been well maintained and is reflected in the in-

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creased activities of the Societies subsidized under the Ministry's Heavy Horse Breeding Scheme. These good results have been obtained in the face of keen competition from privately-owned stallions. Some of these stallions travel at very low fees, and in a few instances on a payment by results basis—that is “no foal, no fee.”

In the report for 1935-36, attention was directed to the show record of the progeny of one of the stallions subsidized under the Scheme. Further prizes won by the progeny of this stallion at the 1937 Shire Horse Show were: Junior and Supreme Champion, Senior Champion, and Reserve Supreme Champion, 1st in Group Class, 1st (and Reserve Junior Champion) in yearling colts, 4th in two-year-old colts, 2nd and 7th in yearling fillies. In addition, numerous prizes were won at County and other shows, and the principal prize winner at the Shire Horse Show was also the Champion Stallion at the Royal Show.

The progeny of premium stallions from a Welsh District won 1st, 2nd, 3rd, and 5th prizes in the class for geldings at the Royal Show, and both championships at the West of England Show at Hereford. A four-year-old gelding sired by a premium stallion in Lancashire was 1st in its class at the Shire Horse Show.

Good prices have also been obtained at sales for the progeny of premium stallions, a three-year old gelding fetching 80 guineas at Crewe, a yearling gelding £80 at Lanark, a two-year-old gelding 74 guineas and a filly foal 70 guineas at Wigton. Good prices were also realized at the Suffolk Horse Society's sales.

Grants were paid in respect of 8 more stallions than in the previous year. The average hiring fee per stallion showed a reduction of £2, but the average service fee was practically unchanged.

The Regulations permit of the award of one Assisted Nomination to a mare owner and 5,288 small farmers (or 370 more than in the previous year) were enabled by the Scheme to have a mare served by a good-class stallion. The total number of mares served, 18,988, shows an increase of about 1,200 over the previous season, whilst the average number of mares per stallion increased by 2.

There were 150 Shire, 22 Clydesdale and 21 Suffolk stallions travelled under the Scheme in 1936, compared with 144 Shire, 22 Clydesdale and 19 Suffolk stallions in 1935.

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TABLE XI.—HEAVY-HORSE SCHEME

<i>Service Season</i>	<i>No. of Stallions</i>	<i>Total No. of Mares served</i>	<i>Average No. of Mares served</i>	<i>No. of Assisted Nominations</i>	<i>Average Hiring Fee of Stallions</i>	<i>Average Service Fee</i>	
					£	£	s. d.
1914 ..	72	6,365	68	1,503	231	2	8 6
1915	97	9,122	94	2,430	241	2	9 6
1916	108	9,995	92	2,181	244	2	11 0
1917	110	10,556	96	2,151	258	2	16 3
1918	122	12,281	100	2,165	285	2	15 8
1919	118	10,920	96	1,996	317	3	6 3
1920	105	9,133	87	1,839	345	3	13 1
1921	101	7,888	78	1,943	333	3	13 7
1924	87	6,098	70	*	178	2	7 0
1925	96	7,413	77	1,723	194	2	8 4
1926	93	8,165	83	2,171	208	2	8 6
1927	105	8,950	85	2,599	211	2	8 9
1928	114	9,792	86	2,805	217	2	9 4
1929	120	10,196	85	3,052	221	2	9 9
1930	140	12,248	87	3,604	239	2	11 1
1931	159	14,226	89	4,266	235	2	10 2
1932	162	14,624	90	3,945	226	2	9 9
1933	165	15,655	95	4,280	220	2	10 8
1934	170	16,071	95	4,353	221	2	10 6
1935	185	17,548	95	4,710	231	2	10 8
1936	193	18,778	97	5,078	229	2	10 10

* No grant was made by the Ministry for assisted nominations (except to the Cumberland and Westmorland Society) for the service season 1924.

The number of foals resulting from the services of subsidized stallions in 1935 was 9,734, an increase of 475 over the previous year. The percentage of foals to the total number of services was 57.4, as compared with 58.5 in 1934. The average foaling percentages of stallions of the three breeds were Shire 59.1, Clydesdale 53.0, and Suffolks 67.2.

The figures in Table XI do not include those relating to the Cumberland and Westmorland Heavy Horse Breeding Society, which issues assisted nominations to selected stallions travelled by their owners in Cumberland and Westmorland. The figures for this Society are:—

<i>Service Season</i>	<i>No. of Assisted Nominations</i>	<i>Service Season</i>	<i>No. of Assisted Nominations</i>
1915 ..	385	1927 ..	247
1916	394	1928	281
1917	328	1929	283
1918	321	1930	269
1919	264	1931	290
1920	254	1932	198
1921	255	1933	217
1924	121	1934	209
1925 ..	197	1935 ..	208
1926	220	1936	210

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NOTE.—Further information regarding the improvement of Live Stock is given in the following memoranda, copies of which may be obtained (single copies free of charge) on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1 :—

Form No. A763/T.L.—Scheme for the Improvement of Live Stock.

Form No. 609/T.L.—Bull Grant Regulations.

Form No. 466/T.L.—Boar Grant Regulations.

Form No. 89/T.L.—Heavy Horse Regulations.

Form No. 392/T.L.—Milk Recording Regulations.

Butter-fat Testing Regulations.

Regulations relating to the Progeny Recording of Dairy Bulls, which are printed as separate pamphlets).

Form No. A899/T.L.—Guide to the Licensing of Bulls in England and Wales.

(To be concluded.)

MARKETING NOTES

Milk Marketing Scheme. Pool prices and rates of producer-retailers' contributions for September, 1937, are given below, with comparative figures for August, 1937, and September, 1936. The wholesale liquid milk price in September, 1937, was 1s. 3d. per gal., 2d. per gal. more than in August, 1937, but the same as in September, 1936.

Region	Pool Prices			Producer-Retailers' Contributions		
	Sept. 1937 d.	Aug. 1937 d.	Sept. 1936 d.	Sept. 1937 d.	Aug. 1937 d.	Sept. 1936 d.
Northern	12½	10½	11½	2½	2½	3½
North-Western	12½	10½	11½	2½	2½	3½
Eastern	12½	10½	12	1½	1½	2½
East Midland	12½	10½	11½	2½	2½	2½
West Midland	12	10½	11½	2½	2½	3½
North Wales	12	10½	11½	2½	2½	3½
South Wales	12½	10½	11½	2½	2½	2½
Southern ..	12½	10½	12	1½	1½	2½
Mid-Western	12	10½	11½	2½	2½	3½
Far-Western	12	10	11½	2½	2½	3½
South-Eastern	13	11	12½	1½	1½	2½
Unweighted Average	12·39	10·41	11·64	2·21	2·19	2·96

These prices are exclusive of any premiums for special services and level deliveries, and also of the Accredited producers' premium of 1d. per gal.

The accredited premium was paid on 27,668,068 gal., and the sum required for the payment of the premium was equivalent to a levy of .355d. per gal. on pool sales.

The inter-regional compensation levy was fixed at 1d. per gal., compared with 1½d. per gal. in September, 1936.

Sales on wholesale contracts were as follows:

	Sept. 1937 (estimated) Gallons	Sept. 1936 Gallons
Liquid	49,261,035	46,799,737
Manufacturing	18,161,408	26,853,818
	<hr/> 67,422,443 <hr/>	<hr/> 73,653,555 <hr/>
Percentage liquid sales	73·06	63·54
Percentage manufacturing sales ..	26·94	36·46

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The average realization price of manufacturing milk during September was 6.425d. per gal. compared with 5.66d. per gal. for September, 1936. The quantity of milk manufactured into cheese on farms was 2,302,175 gal. compared with 2,739,526 gal. in the previous month and 2,148,191 gal. in September, 1936.

Bacon Development Scheme: *Renewal of Existing Licences.*
The Bacon Development Board have made the following announcement:—

“ The Bacon Development Scheme conferred upon curers a right to a licence for two years from the establishment of the Scheme in respect of any premises in which bacon was produced at any time during the six months from November 17, 1934, to May 16, 1935. The Bacon Development Board wishes to remind curers that this two-year period expired on September 7, 1937. The Board, therefore, has now the power on certain grounds to refuse to renew the existing licences, which expire on December 31 next.

“ The subject of reorganization of the pigs and bacon industry, however, is at present under discussion by the Ministry of Agriculture and Fisheries with the Bacon and Pigs Marketing Boards, following the Minister's announcement of July 29, 1937, on Government policy with regard to pigs and bacon. The Development Board, therefore, considers that the present would be an inopportune moment to employ its powers to terminate existing licences, and has decided not to refuse licences for 1938 in respect of any existing licensed premises except in cases where a previous licence has been revoked.

“ Apart from any such exceptional cases, therefore, existing licence holders will in due course receive a further licence without application, to take effect from January 1, 1938.

“ This decision must not, of course, be held to prejudice the right of the Board in any future year to exercise its full powers to refuse to renew licences if this should be considered necessary, or to revoke existing licences at any time if conditions are contravened.”

Potato Marketing Scheme: *Board's Report for 1936-37.*
The fourth annual report of the Board contains an interesting account of the operation of the scheme during the year ended August 31, 1937.

The number of producers registered under the Scheme in

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England and Wales was 50,480 and in Scotland 13,345, a total of 63,825. As last year, the Holland Division of Lincolnshire with 4,303, had the greatest number of producers and Radnor with 5, the lowest. The average potato acreage planted by producers in Great Britain was 8.1 acres.

Price Recommending Committees, whose mission, the Report states, is "to educate all concerned as to fair prices of potatoes which should and can be obtained," have operated in 19 areas during the past maincrop season. The Board expect this policy to expand, and, if wisely applied, to create an atmosphere of stabilization.

The Board have continued and extended their publicity campaign. Demonstration theatres were erected at a number of exhibitions and a series of posters was displayed over a period of months on the London Underground Railway system. Direct mail advertising was undertaken with women's organizations and all retailers known to the Board were circularized with a suggestion that they should apply for advertising material to display in their shops. For the purpose of stimulating the demand for home-grown "earlies" some 24,000 window pelmets and 40,000 posters for display by retailers and fish friers were distributed, and posters were exhibited on the railway systems.

Riddle Regulation. A new riddle regulation fixing a 1½-inch minimum riddle for Golden Wonder was made by the Board on October 7, 1937, to operate from that date until further notice.

Milk Acts 1934 to 1937: Milk-in-Schools Scheme. The following figures show the gallonage of milk consumed in the first ten months of the third year of the scheme compared with the corresponding period in the first and second years. The figures for the third period will be slightly increased when further returns are received.

		<i>Gallons</i>	<i>Exchequer Contribution</i>
October, 1934, to July, 1935	..	20,419,858	£377,921
October, 1935, to July, 1936	..	19,315,291	£373,951
October, 1936, to July, 1937	..	19,656,082	£380,961

Cheese and Butter Milk Prices. For the purpose of payments under the Milk Acts (whether by the Exchequer to Milk Marketing Boards or by Boards to the Exchequer) in respect of milk used for manufacture, the Minister and the Secretary

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of State for Scotland, with the approval of the Treasury, have certified the ~~cheese~~ milk price and the butter-milk price to be 6.06 pence and 4.31 pence per gal. respectively for the month of August, 1937.

Experimental Cheap Milk Schemes in the Special Areas. With the co-operation of the Commissioner for the Special Areas, the Whitehaven Borough Council, the local distributors, the Whitehaven Council of Social Service and the Cumberland Friends' Unemployment Committee, the Milk Marketing Board on October 1, inaugurated a scheme for the supply of milk to expectant and nursing mothers and to children under school age in the Borough of Whitehaven, Cumberland, at the price of 2d. per pint. This scheme is on similar lines to schemes previously started and still in operation in other parts of the Special Areas, namely, the Rhondda Valley, Jarrow, and Walker-on-Tyne. In all these schemes each consumer within the eligible categories is allowed a minimum of 1 pint per day delivered to the consumer's house. The distributors accept a reduced margin of 8d. per gal. and the Milk Marketing Board and the Commissioner for the Special Areas each contribute half the amount necessary to enable the milk to be sold at the reduced price. The Whitehaven Council of Social Service and the Cumberland Friends' Unemployment Committee are making a grant towards the expense incurred by the Whitehaven Council in administering the scheme, and in addition are making a special grant to enable milk to be supplied at 1½d. a pint to certain necessitous applicants.

Wheat Act, 1932: Sales of Home-Grown Wheat—Cereal Year, 1937-38. Certificates lodged with the Wheat Commission by registered growers during the period August 1 to October 8, 1937, cover sales of 3,748,960½ cwt. of millable wheat as compared with 2,979,142 cwt. in the corresponding period (to October 9) in the last cereal year.

Sugar Industry (Reorganization) Act, 1936: Annual Report of the Sugar Commission. The first annual report of the Sugar Commission on the discharge of their functions under the Act during the year ended March 31, 1937, has now been published by H.M. Stationery Office, price 6d. net.

White Sugar Programme for 1937-38 of the British Sugar Corporation. The Sugar Commission made an Order on August 31, under Section 6 (1) of the Act, approving the

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arrangements of the British Sugar Corporation for the production and marketing of White Sugar during the year ending March 31, 1938.

Livestock Industry Act, 1937. *Livestock Commission.* Mr. R. N. Jones and Dr. J. M. Newnham have been appointed by the appropriate Ministers to be members of the Livestock Commission. Mr. Jones was formerly the Ministry's Superintending Livestock Officer for Wales, and Dr. Newnham has just retired from the office of Town Clerk of Croydon. These appointments bring the number of members of the Commission up to the maximum of nine for which the Act provides. The names of the other members of the Commission were given on p. 431 of the August, 1937, issue of this JOURNAL.

Cattle Fund. The following table gives particulars of payments made out of the fund set up under the Cattle Industry (Emergency Provisions) Acts 1934 to 1936 and the Livestock Industry Act, 1937:—

Period		Payments	Animals	Average Payment per Animal		
				£	s.	d.
April to September, 1935	..	1,848,830	782,320	2	7	3
April to September, 1936	..	1,918,488	826,055	2	6	5
April to September, 1937*	..	1,883,902	795,004	2	7	5
From commencement of subsidy						
payments to September 30,						
1937	.. .. .	11,763,404	4,962,609	2	7	4

* The payments of August and September, 1937, comprised £90,802 for 39,206 animals certified under the Emergency Provisions Acts, and £270,227 for 84,714 animals of quality standard and £255,963 for 128,655 of ordinary standard certified under the 1937 Act.

Fat Stock—Carcass Sale by Grade and Dead-Weight. During the three months ended September 30, 1937, 898 consignments comprising 2,738 cattle, 8,757 lambs and sheep and 1,227 pigs were dealt with under the Grade and Dead-weight Scheme.

Bulk consignments of stock forwarded during this period through local organizations in Northern Ireland, or through group agents operating in Mid and South Wales totalled 4,177 lambs and sheep and 87 cattle.

National Mark Beef. During the three months ended September, 1937, a total of 81,427 sides of beef (58,849 home-killed and 22,578 Scotch-killed) were graded and marked under the National Mark. The home-killed sides dealt with

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graded 28 per cent. "Select," 66 per cent. "Prime," and 6 per cent. "Good." Scottish National Mark sides graded 86 per cent. "Select" and 14 per cent. "Prime."

National Mark Canned Fruit and Vegetables. The canning of most kinds of fresh fruit and vegetables has now ceased for this year. Certain kinds of vegetables (e.g., carrots, celery) are still being canned and the apple pack is likely to be short owing to failure of the crop.

The total National Mark pack of fresh fruits and vegetables is unlikely to exceed that of last year.

Resulting from exceptionally favourable fruit-growing and harvesting periods, National Mark packs of strawberries were larger and of better quality than for any year since 1932.

The National Mark pack of gooseberries was smaller than usual owing to a partial crop failure.

The total pack of National Mark raspberries exceeded that of last year and was generally of very good quality.

Owing to an unexpected revival of the demand for canned loganberries and for other reasons many canners were unable to procure their total requirements of this fruit, although yield and quality were well up to average.

Very few black currants were packed under the National Mark, but there was a slight increase in the pack of cultivated blackberries.

A very large crop of Pershore Egg (Golden) Plums at low prices resulted in the production of packs at least equal to those of last year. The Victoria plum and damson packs, however, were substantially lower, although it is possible that the damson pack would have been larger if prices for this fruit had not opened so high. The final damson price was in many instances less than half of that at which forward deliveries were quoted. All stone fruits were generally better in quality than the average year's crop.

A further increase in the contracted acreage of fresh peas was offset by lower yields, and the total pack is probably not larger than that of last year. Here again the general quality level was higher than for several years.

Although improvements in mechanization are tending to reduce production costs, there is still no marked increase in the pack of other kinds of vegetables permitted for canning under the National Mark.

The competition from English canned fruits packed to a

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lower standard continues to have marked effect on the demand for National Mark Canned Fruit, and packers under the National Mark are experiencing difficulty in obtaining the higher price justified by the greater production cost and the greater reliability of the National Mark Product.

National Mark Wheat Flour Scheme: *Bakers' and Confectioners' Exhibition, 1937.* In the British Wheat Flour Competition held at this Exhibition eleven entries were received from authorized millers in the National Mark Wheat Flour Scheme in the class for all-English (Yeoman) Wheat Flour milled to National Mark standards. The gold, silver and bronze medals and diplomas offered by the Ministry to the winning entrants were awarded by the judges as under:—

Gold Medal and Diploma	..	James Nutter, Station Mill, Fulbourn, Cambridge.
Silver Medal and Diploma	..	T. Burgess & Sons, Thornton Dale, Pickering, Yorks.
Bronze Medal and Diploma	..	S. Edwards & Son, Beech Flour Mills, Bishop's Stortford, Herts.

The gold medal offered by the Ministry to the farmer supplying the largest proportion of wheat used in the winning flour was gained by Messrs. Chivers & Sons, Ltd., Histon, Cambridge.

The National Farmers' Union offered prizes in Class 60 for the best All-English milk loaf made from National Mark flour. Entries by 19 firms were submitted, and the prizes were awarded as follows:—

First Prize	..	H. Hampson, Charles Street, Wrexham.
Second Prize	..	W. Duxbury, Worksop Co-operative Society, Ltd., Eastgate, Worksop.
Third Prize	..	J. W. Skinner, Old Cross, Hertford, Herts.

National Mark Publicity. An apple packing demonstration will be arranged at the East Kent Commercial Fruit Show, Canterbury, on November 16-18. At the South Wales Grocers' Exhibition, Swansea, an egg grading demonstration will be staged; a comprehensive range of National Mark products will be displayed and samples will be on sale during the period November 17-27. A display of National Mark turkeys will be staged at the Norfolk Fatstock Show, Norwich, November 18-20. A full range of the Ministry's publications will be on sale at each Show.

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In connexion with the special Empire feature to be incorporated in the Lord Mayor's Show, the home county will be represented by a tableau depicting National Mark produce arranged by the Ministry, and by agricultural tableaux arranged by the National Farmers' Union and other bodies. Similar exhibits covering Dominion and Colonial produce are to be arranged by the respective Governments.

Supplies and Prices of Maincrop Potatoes in the 1936-37 Season: Supplies. Generally speaking, supplies of maincrop potatoes on the market in Great Britain during the 1936-37 season showed little change from those in the previous season. Although the acreage under potatoes in Great Britain in 1936 showed a slight decline, estimated yield per acre increased, and the total production of potatoes of all kinds was slightly above that in the previous season, when it was unusually low. Total production was, however, still below the ten-year average for the period 1926-35, although the average yield per acre was about the same.

Despite the slight increase in total production, it appears that total available supplies of maincrop potatoes were rather less than those of the previous season, principally owing to the fact that a larger quantity of the total production figure represented first earlies. The following table shows, for each of the past seven seasons, the estimated total production of potatoes in Great Britain, and the maincrop supplies available for human consumption after deducting first earlies, exports and seed, and adding shipments to Great Britain from Northern Ireland and imports into the United Kingdom:—

			<i>Total Production (000 tons)</i>	<i>Approximate Net Maincrop Supplies* (000 tons)</i>
1930-31	..	..	3,603	3,180
1931-32	..	..	3,154	3,270
1932-33	..	..	4,450	3,740
1933-34	..	..	4,555	3,750
1934-35	..	..	4,464	3,740
1935-36	..	..	3,765	3,305
1936-37	..	..	3,804	3,205

* Including wastage and livestock feed.

In the light of the situation outlined above, the Potato Marketing Board considered it desirable to provide for some

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relaxation of the riddle regulations, and from November 20 the basic minimum riddle of $1\frac{1}{2}$ in. was in operation for the rest of the season. Provision was also made for the sale of "seconds," i.e., potatoes below the ordinary minimum standard size, for human consumption.

Regulation of Imports. Imports of potatoes into the United Kingdom were controlled as hitherto under the Potato (Import Regulation) Order, 1934, but supplies available for export were again short on the Continent, and even with prices at home higher than in the two previous seasons imports fell considerably below the maximum quantities permitted under the Order.

Over the whole season from September, 1936, to June, 1937, inclusive, imports totalled rather more than 126,000 tons.

The following table shows, month by month, the imports of maincrop potatoes into the United Kingdom during the 1936-37 season, and comparable figures for the two preceding seasons:—

				1934-35	1935-36	1936-37
				tons	tons	tons
September	..	..	..	*	100	100
October	..	..	..	1,800	800	1,500
November	..	..	..	700	1,000	8,900
December	..	..	..	500	5,700	23,700
January	..	..	..	1,500	21,500	14,100
February	..	..	..	500	17,300	9,200
March	..	..	..	1,100	18,900	12,800
April	..	..	..	400	24,000	28,400
May	..	..	..	500	26,400	17,400
June	..	..	..	1,400	7,300	10,200
				<hr/> 8,400	<hr/> 123,000	<hr/> 126,300

* Under 50 tons.

Shipments to Great Britain from Northern Ireland during the 12 months September, 1936, to August, 1937, amounted to 192,000 tons as against 234,000 tons in 1935-36 and 122,000 tons in 1934-35.

Prices. Except for September, growers' prices and whole-sale prices throughout the 1936-37 season were appreciably higher than those of the preceding season, and were far above the low prices realized in the 1934-35 season. Rising steeply during the first few weeks of the season, prices remained fairly stable from the end of October, being well above the 1935-36 prices to the end of December, and then continuing steadily at a figure slightly above the previous year's levels

MARKETING NOTES

to the middle of March. In late March and early April, as supplies became more scarce, a further sharp rise took place, after which prices remained considerably above the last year's levels until June, when the usual seasonal fall in growers' prices occurred.

Month	1934-35			1935-36			1936-37			
	Per ton	Index		Per ton	Index		Per ton	Index		
	s.	d.		s.	d.		s.	d.		
September	..	117	0	158	108	6	147	110	6	149
October		109	0	151	109	6	152	145	6	202
November		103	6	146	113	6	160	148	6	209
December		95	0	133	132	6	185	157	6	220
January		92	6	121	154	0	201	156	6	205
February		89	6	116	154	0	200	155	0	201
March		85	0	108	151	6	193	157	0	200
April		86	0	95	149	6	164	173	6	191
May		101	6	113	156	0	174	175	6	196
June		129	0	137	150	6	160	177	6	189
Mean	..	101	0	128	138	0	174	156	0	196

The above table shows the average monthly wholesale price of potatoes* in seven of the principal markets in England and Wales during the past three seasons. The wholesale price index, based on prices in the corresponding months of 1911-13, is also given for each month.

Retail prices throughout the season showed very little variation from those ruling in the 1935-36 season, which were, however, considerably above those of the preceding three seasons. The averages of the monthly retail indices from September to May in the four seasons 1933-34, 1934-35, 1935-36 and 1936-37 were 108, 124, 148, and 149 respectively.

* Average of 1st and 2nd qualities Majestic and King Edward.

NOVEMBER ON THE FARM

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At the time of writing (October 13) dry weather continues. Harvest is practically completed; on some farms it is nearly two months since the last sheaf was gathered in, but such is the variety of conditions even in a small country that in some parts of Yorkshire and Lancashire harvesting is still going on in the middle of October. The dry spell has enabled many to get on with autumn cultivation, but in some areas the land is so hard that ploughing is impossible, and, apart from dung carting that cannot be continued indefinitely, as the supply comes to an end all too soon on most farms, cultural work is held up.

Steam tackle and heavy tractor implements have been able to carry on in many instances where horse-drawn implements have been beaten. It is not often work is held up at this season of the year on account of dry weather. Whatever the reason, it is always a source of concern to the arable farmer when autumn cultivations lag behind.

Potatoes are being lifted under dry conditions and this is likely to be an advantage where disease is present. From most districts there are reports that disease is present in the tubers. The removal of apparently diseased tubers and careful clamping are desirable to reduce risk of serious loss during the winter. Most potato growers will now be in a position to review the growth of the 1937 crop, and to make deductions that should be helpful for future years. Effects of cultural conditions, manuring, variety and stock of seed are points that can be noted.

Growers of earlies will already have considered the provision of seed for 1938, but the question will still have to be faced by many farmers.

Different stocks of the same variety may vary greatly in cropping power, just as different lots of Shorthorn or Angus feeding bullocks may vary in the return they give for food

consumed. Not all feeding cattle of a particular breed and age have the same value, and the farmer, therefore, carefully inspects and examines the animals before purchase.

There is often quite as much at stake in the purchase of a wagon of seed potatoes, and the difference in results obtainable is quite as great as with different lots of cattle. It is, therefore, desirable that the purchaser should make sure as far as is possible that he plants seed tubers that are saved from healthy, vigorous stocks and therefore likely to produce a satisfactory crop. Seed from good stocks is worth much more than seed from poor stocks, which may sometimes be valueless.

At Cockle Park in 1922, two stocks of Arran Banner from the same district were planted side by side. One of them yielded $14\frac{1}{2}$ tons per acre, but the other yielded only $5\frac{1}{2}$ tons. Leaf Roll was responsible for the lower yield.

King Edward still retains its popularity with the public in the Midlands and South, but it seems to be losing favour with growers. Unless another variety, with King Edward characteristics, but which crops better and is more vigorous, comes along, the public may have to pay more for their favourite.

Finger-and-Toe Disease. On many farms this disease is responsible for very considerable loss in swedes and allied crops. The fungus responsible for the trouble flourishes in sour or acid soils. Preventive measures, therefore, involve correcting the soil acidity. Government assistance with regard to the purchase of lime will no doubt act as an incentive to many farmers to tackle the question. As has already been pointed out in these notes, it is important to ascertain the exact extent of the need for lime to correct the acidity, and county agricultural staffs are prepared to give assistance when called upon. Trials carried out for a number of years from 1904 to 1914 at Cockle Park, showed that lime reduced losses from finger-and-toe disease, and on fields where serious loss was experienced no signs of trouble have been seen for twenty-five years. On infected land it is important that enough lime should be applied to neutralize the acidity, and the need for thorough mixing in the soil cannot be overstressed. To enable the lime to get thoroughly mixed throughout the soil it is often desirable to apply the lime as soon as possible after the diseased crop has been removed and not to wait until just before the next swede or other cruciferous crop is to be sown.

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Manure from stock to which diseased roots have been fed is likely to carry the fungus and may thus spread the disease to fresh and clean ground. It is often best to use such manure on permanent grass land.

The lengthening of the rotation so that crops subject to the disease are taken at as long intervals as possible assists in reducing risk of disease. This is advantageous when cruciferous weeds such as charlock, shepherd's purse, etc., are kept in control, since they act as a host for the fungus, which can thus be carried over until the next susceptible crop is sown.

Cattle in the North will now generally have taken up their winter quarters. Outlying cattle, having to face more rigorous climatic conditions, and pasturage that is deteriorating, will require some hand feeding.

When cattle have grown their winter coats a falling off in condition may not readily be noticed. It is advisable that cattle should be kept going on, as loss in condition has to be made up in future. In most instances on exposed farms or where pasturage is short, an allowance of hay should be given. It is usually better to prepare outlying cattle to withstand adverse weather conditions than to rely on providing food after the storm has started. A dry lie is important for outlying cattle and contented animals thrive best. When food is being given to animals out of doors it is desirable that it should be given early, as animals stand looking for it and never settle after daylight. As regards hay feeding to stock in the open, "early in the season and early in the day" is a good rule.

After yard- or stall-fed cattle have been on their rations for two or three weeks their progress can be estimated, and, where necessary, changes made. Owing to the seasonal variations in roughages that supply a large portion of the protein and starch equivalent, it is often necessary to make an alteration in the concentrates fed. There is little point in fixing the ration of concentrates to an exact figure from season to season, if the roughages vary greatly. It is desirable that some measure of the feeding value of the roughage should be obtained, but this is not always possible. Variations in the quality of the available food and the ability of animals to utilize what they receive, still leaves ample room for the skill of the feeder in judging the progress and requirements of a particular lot of animals. There is much truth in the saying "It is the farmer's eye that feeds the cattle." Feeding

NOVEMBER ON THE FARM

standards are a most useful guide, but it is important that they should be applied to conditions to which they fit.

Most successful feeders actually give rations that very nearly comply with recommended standards, although perhaps not realizing it. There are still instances in which unsuitable rations are fed, with resulting loss, and it is desirable that feeders should seek help of the county staffs if in any doubt as to feeding matters.

Wheat. The abnormally dry weather has not produced the most favourable conditions for sowing wheat, which likes a firm seed bed. The use of the roller when the soil is very dry may help in this respect. It is not often that the roller can be used with safety at this season of the year, but if conditions are favourable it can be most useful.

Most farmers dress their seed grain before sowing. In spite of this, numerous crops have shown the presence of bunt. It is most important that the dressing should be effectively carried out, otherwise some spores may be left that are capable of infecting the young plant.

On many farms last season it was not possible to get wheat sown in the autumn after sugar beet. A start has already been made with beet lifting and much progress made. Sugar beet tops and crowns are valuable feed, and if time permits they should be collected and ensiled before ploughing for wheat.

Sheep. The present month is one of comparative quiet on most sheep farms. Sales are over, ewes have been lotted for rams and in most instances will be already in lamb. On hill farms the rams are still to be turned away.

On many grass farms keep is short and early supplementary feeding may be necessary.

Attention to the general well-being of the sheep is the shepherd's chief work during the present month and this includes a sharp look-out for disease, as well as attention to food supply. Especially amongst young sheep on pasture, troubles from parasitic worms are likely to occur. Where young sheep are not making the expected progress worm troubles may be suspected, and an examination should be carried out. Veterinary surgeons are able to give much help in controlling these troubles, which are capable of causing serious loss. It is gratifying to note that in connexion with sheep husbandry greater

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use is being made of the preventive and curative measures available. Needless to say it is of vital importance to adopt treatment in the early stages; infected sheep are probably only suffering from a more advanced condition of disease that is infecting the remainder of the flock.

Meetings. The winter season of agricultural discussion societies and lectures to farmers has now commenced. For the most part these are well organized and arousing increasing interest.

Two valuable features more evident in recent times are the introduction of lecturers, who have special knowledge, to deal with particular subjects, and the increasing use made of practical farmers who have been successful in various branches of the industry.

It is good, on the one hand, that the scientific principles involved in agriculture should be explained and understood, and, on the other, that their working out should be illustrated and discussed by successful practitioners.

NOTES ON MANURING

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Soil Condition and Response to Fertilizers. Much farming practice is still largely based on tradition or actual experience. Knowledge and tradition are handed down in a variety of ways, but a good deal is lost in the process and each succeeding generation of farmers has to learn many things by experience. To the individual farmer a single season frequently seems different from all its predecessors; a plan which succeeds in one year may fail in the next. Nevertheless, each season leaves behind some fresh experience to be included in the general store of knowledge on which plans for future seasons are based. It is always interesting to review the events of a past season to discover what can be learnt from them.

A wet winter and spring following the wet summer of 1936 produced, during 1937, soil conditions entirely different from those prevailing in recent years. Indeed, many farmers contend that soil conditions similar to those that prevailed in the winter of 1936 and the spring of 1937 have not been experienced for very many years. Some arable farmers found it impossible to sow their projected acreage of winter corn, and winter ploughing was badly delayed. Spring weather brought little relief from the surplus water problem and in many places added to it.

Much winter-sown corn, especially on heavy clay soils, lay waterlogged long after active spring growth should have commenced, and miniature lakes were sometimes seen even on light soils, where these overlie a clay substratum. Much spring corn was sown unusually late and frequently in a tilth far from satisfactory, whilst seed beds for root crops were generally below standard. These defects in the physical condition of the soil had a lasting effect on plant growth in many fields. Crop failure due to excessive wetness; poor and irregular plant establishment caused by poor tilth at seeding; late-sowing of crops; weak or retarded growth due to soil poverty consequent on the leaching out of available plant food; and, in some heavy-land districts, fields left unsown because the land could not be got ready in time—all these have borne

NOTES ON MANURING

witness throughout the spring and summer to the difficulties of the season now drawing to a close.

The first and most obvious lesson to be learnt from these events is of course the need for improving the drainage of the land in many parts of the country. Most farmers could well have been spared this object lesson, however, for they already realized the necessity for this work and it is largely the matter of expense that has prevented them from making the necessary improvement in the past, at any rate so far as the actual field drains are concerned. Though the Government's recent proposals granting financial assistance for land drainage do not apply to the routine drainage of individual fields they should at least help to render more fully effective any field drainage undertaken by the farmer. In the past a farmer's efforts at field drainage were not infrequently nullified by the bad conditions of the water-course into which his drainage water must flow, and it is to be hoped that the responsible authorities will take the fullest possible advantage of the assistance which is now available for improvements in this direction.

Reference to land drainage may, to some readers, appear to be outside the scope of notes on manuring, but it is safe to say that a very large part of any money spent on the application of fertilizers to land in need of drainage is inevitably wasted. This statement has been made many times in the past but its truth is even now not always appreciated. In advisory work one still encounters farmers who have lost faith in artificial fertilizers largely because they failed to produce a good crop on land that really needed draining. As suggested later in these notes, the effects of infrequent or exceptionally bad spells of wet weather can sometimes be mitigated by the intelligent use of fertilizers, but regular or prolonged water-logging will usually reduce very considerably any benefits that might otherwise accrue from manuring.

Other points of major importance from the standpoint of manuring and soil management also arise from the events and experience of the past season. Realizing that the wetness which led to so much loss of physical condition would simultaneously cause a reduction in the available nutrient content of the soil, many farmers increased their usual dressings of artificial fertilizers in the spring of 1937, in an attempt to make good the losses caused by the washing out of the soluble plant foods during the wet winter months. Very few of these farmers have had any cause to regret this action, whilst many crops

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that received only their usual dressings, or no fertilizers at all, have provided convincing evidence of the serious deficiency of soluble plant nutrients that inevitably follows a prolonged spell of wet weather.

As might be expected, the effects of late spring applications of quick-acting nitrogenous fertilizers have been particularly noticeable throughout the summer and there is little doubt that this year even a crop so sensitive to excess nitrogen as malting barley, has, in many instances, benefited from an increased dressing of nitrogenous fertilizer. On the evidence of the past season it is obviously very desirable that careful reconsideration should always be given to the manuring programme, more especially the supply of nitrogenous fertilizer, after a long period of wet weather.

A standard manuring scheme for the rotation has been advocated in previous notes on manuring, but with the proviso that the quantity and time of application of the quick-acting nitrogenous fertilizer should always be governed by circumstances. Artificial fertilizers supplying plant food in a form readily available to the growing crop have proved a valuable help in all seasons, but they should be especially valuable in seasons such as 1937, when their intelligent utilization can mitigate, even if it cannot completely overcome, the harmful effects of a prolonged spell of unfavourable weather conditions. Despite all that has been done in the past to spread a sound knowledge of the utilization of fertilizers, there is still scope for a great extension in their use to combat what might be called emergency conditions. As farmers themselves sometimes point out, the most valuable application of fertilizer is often that which encourages a crop to grow when soil and climatic conditions are unfavourable to plant growth.

This brings us to another point of immediate practical importance arising from the conditions experienced in 1937. Even where liberal manuring is practised crops do not always turn out completely satisfactory. The harmful effects of water-logging have already been mentioned. In other instances met with during the past summer, there was no doubt that the condition of the soil itself was the cause of unsatisfactory crop growth. This was frequently due to the land drying so slowly in the spring that there was not time to perform all the cultivations necessary to produce a good tilth before seeding. The physical condition of a soil affects root development and the movement of soil moisture, both that which is surplus

NOTES ON MANURING

to requirements and that which is necessary for crop growth. Hence it controls, directly or indirectly, the supply of moisture and plant food to the crop and the removal of surplus water from the land. It has recently been suggested that too much emphasis is sometimes placed on the value of cultivations. Though this statement may sometimes be true it is equally true to say that no amount of fertilizer will completely compensate for a bad tilth.

Autumn-Sown Cereals. A natural inquiry arising out of the above discussion is whether or not any modifications should be made this autumn in the usual manuring of autumn-sown cereals. Though the taking of too frequent crops of cereals is open to criticism on biological grounds, the increase in the quantity of wheat that will rank for deficiency payments under the Wheat Act next year will encourage farmers to plant their full acreage of wheat this autumn and to try to get the best possible yield.

Where wheat is following potatoes, roots, clover or "seeds" an autumn application of artificial fertilizer should not be necessary, but where it is following another cereal crop a dressing of either farmyard manure or artificial fertilizers should usually be applied before sowing the wheat. A suitable dressing of artificials is generally about 2 to 3 cwt. per acre of superphosphate, and, on very light or chalky soils, $\frac{1}{2}$ cwt. per acre of muriate of potash. To defer the application of phosphate until the spring is *not* to be recommended. It should always be worked into the seed bed before the corn is sown and it will then encourage the early establishment of a strong and well-rooted plant. Where potash is necessary, this also is best applied in the autumn; it will not be washed out of the soil even in a wet winter. For wheat following another cereal crop it is sometimes desirable to give a little nitrogenous fertilizer in the autumn. This seed bed application is well worth considering this autumn, especially where the preceding crop showed signs of suffering from poverty. Where circumstances seem to warrant it, a dressing equivalent to about $\frac{3}{4}$ cwt. per acre of sulphate of ammonia may be applied. An application of nitrogenous fertilizer should not, of course, be given in the autumn if farmyard manure has also been applied. On the other hand, an autumn application of nitrogenous fertilizer will not necessarily do away with the need for a further dressing next spring. Unless the coming winter proves

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exceptionally dry a spring top dressing of quick-acting nitrogenous fertilizer will be required on many fields. If the crop winters well the spring dressing should not be given until late April or early May.

In view of the reduction in the cost of basic slag to the farmer under the Government's Land Fertility Scheme many farmers may be tempted to use slag instead of superphosphate, and at the same time give enough to start building up a small reserve of phosphate in their soil. So great, however, has been the demand for slag under the Land Fertility Scheme that supplies sufficient for both arable and grass are not likely to be forthcoming this autumn. On soils where superphosphate can be used at least equally well for arable crops, farmers are therefore urged to reserve their purchases of slag for use on grass land.

Winter oats and winter barley, when taken as a second white straw crop, will usually benefit from applications of phosphate and potash similar to those recommended for wheat. With these two crops, even when they follow other white straw crops, it is usual to defer application of quick-acting nitrogenous fertilizer until the spring. This year, however, the possibility of applying $\frac{1}{2}$ cwt. per acre in the autumn, on land known to be in poor condition, seems worthy of consideration.

Autumn application of nitrogenous fertilizer is not likely to be necessary for any cereal crop when seeding can be done in good time. The combination of early sowing and nitrogenous fertilizer would be apt to make the crop "winter proud" unless the soil was unusually poor in available nitrogen.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended Oct. 6				
	Bristol	Hull	L'pool	London	Costs per Unit [¶]
Nitrate of Soda (N. 15½%) ..	£ 8 0c	£ 8 0c	£ 8 0c	£ 8 0c	s. 10 4
" " Granulated (N. 16%) ..	8 0c	8 0c	8 0c	8 0c	10 0
Nitro-Chalk (N. 15½%) ..	7 10c	7 10c	7 10c	7 10c	9 9
Sulphate of Ammonia:—					
Neutral (N. 20·6%) ..	7 6c	7 6c	7 6c	7 6c	7 1
Calcium Cyanamide (N. 20·6%)	7 9d	7 9d	7 9d	7 9d	7 3
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 4	5 1	5 0	5 1	3 5
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%)	8 10	8 8	8 5	8 8	3 4
Sulphate " (Pot. 48%)	10 2	10 0	9 17	10 0	4 2
Basic Slag (P.A. 15½%) ..	2 12b	2 5b	—	2 10b	3 2
" " (P.A. 14%) ..	2 8b	2 0b	2 0b	2 6b	3 3
Grd. Rock Phosphate (P. A. 26-27½%)	2 17a	2 15d	2 15a	2 12a	2 0
Superphosphate (S.P.A. 16%) ..	3 4	—	3 3e	3 0f	3 9
" " (S.P.A. 13½%) ..	3 1	2 17	2 19c	2 16f	4 1
Bone Meal (N. 3½%, P.A. 20½%)	—	7 5	7 5g	7 2	—
Steamed Bone Flour (N. ½%, P.A. 27½-29½%) ..	5 5h	5 10	5 0g	4 15	—

Abbreviations: N. = Nitrogen;
S.P.A. = Soluble Phosphoric Acid;

P.A. = Phosphoric Acid;
Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 5-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 5 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra, and for lots of 4 cwt. and under 1 ton, 20s. extra.

e Prices shown are f.o.r. Widnes.

f Prices shown are f.o.r. northern rails; southern rails, 1s. 3d. extra.

g Prices shown are f.o.r. Appley Bridge.

h Price shown is f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent. nitrogen, contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Winter Keep. The primary function of purchased feeding-stuffs on most farms is to supplement any deficiencies of quantity and quality in the supplies of home-grown produce available for the live stock of the farm, more particularly throughout the winter months. With the onset of winter feeding the time is opportune, therefore, for a review of the general character of these home-grown supplies, with a view to ensuring that the outlay on supplementary foods shall be made with that regard for economy which is always advisable, and, at present price levels, is essential for profitable production.

Foremost among the winter supplies on most farms is grass-land produce, which may be available in one or more of the forms of winter grazing, dried grass, hay, or grass silage. From the arable land, other green crops, such as rape and kale may be available, as well as the root crops that have not been sold off, and the straw from the grain crops.

Grassland Produce. Accurate assessment of the nutritive value of grassland produce is beset by three basic difficulties that are commonplaces of practical experience, namely (1) that different areas of grass land may vary greatly in feeding value; (2) that the value of one and the same area may vary in different seasons and (3) also at different periods of any one season. The explanation of the first and second of these difficulties lies mainly in the variable chemical and physical characters of soils and in their response to fluctuating conditions of rainfall and temperature.

The difficulty arising from the variable character of grass-land produce at different times of the year finds its explanation in the continually changing chemical composition of the growing plants. If the development of the plant is unchecked, as in a field laid up for hay, its chemical composition changes steadily along fairly well defined lines up to the stage of dead ripeness and death of the leaves and stems. If, on the other hand, the produce of the plant is frequently removed in the

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course of the growing season, as in grazing, the chemical changes are not permitted to go as far, so that the variability in composition of the produce in the course of the season is less than in the first case. The composition, and therefore the nutritive value, of the produce of grass land may thus show the whole range of variation from that, at the one extreme, of tender, watery young grass, relatively rich in proteins, vitamins and soluble minerals, (containing certainly also a good deal of fibre, but that of a soft, easily digestible type), to that at the other extreme of late-cut over-ripe hay, especially if badly weathered, which contains but little in the way of useful proteins, vitamins and minerals, and is so heavily loaded with tough, indigestible fibre that it can count for little more than ballast in the ration.

With the advent of artificial drying, material of the first class, that must be described as "dried grass" rather than "hay," has now come into the catalogue of our winter food supplies from grass land. Clearly, however, the produce of the grass drier may show the whole range of variation in chemical composition and nutritive value from that of young grass to that of hay, according to the stage of development of the grass when cut and passed through the drier. Only with perfect co-ordination between the management of the grass land and the operation of the drying machine can this variability be avoided; and even then there will be variation from year to year, and possibly at different times of the year. The correct use of dried grass in any scheme of rationing thus necessitates a knowledge of the precise composition, based upon analysis, of the material to be used; this is all the more necessary if the dried grass is to be regarded as a "concentrate," responsible for part of the "production" effect of the ration.

What the range of variation in composition and nutritive value may be between the two extremes of the best dried grass and the worst hay is indicated by the following data based upon the tables in *Rations for Live Stock* (the Ministry's Bulletin No. 48). The data in all instances are given as percentages of the "dry matter" of the grass or hay. (This basis should always be taken for comparative purposes, since otherwise significant differences between the materials compared may be masked by differences of moisture-content of the materials. This precaution is naturally most necessary when the differences of moisture content are large, as for example in comparing fresh grass with hay.)

NOTES ON FEEDING

PER CENT. OF DRY MATTER

	<i>Digestible Protein Equiva- lent</i>	<i>Main- tenance Starch Equiva- lent</i>	<i>Pro- duction Starch Equiva- lent</i>	<i>Total Fibre</i>	<i>Ash</i>
Pasture Grass, close grazing—					
Non-rotational.. ..	20·7	85·0	73·5	13	10·5
Rotational, 3-week intervals..	17·2	85·0	73·0	15	9·0
" 4- " "	12·2	77·0	67·0	22	9·0
Pasture Grass, extensive grazing—					
Spring Growth.. ..	10·5	67·0	56·0	20	10·0
Winter Pasture (after close- grazing to end of July) ..	8·7	65·0	57·0	22	8·0
Meadow Hay—					
Very Good	9·3	66·5	57·2	23	9·2
Good	5·4	57·0	43·2	30	7·3
Poor	3·4	46·3	25·7	39	5·8

Of the items included in the table the first three (Pasture Grass, close grazing) may be taken as typical of the various grades of dried grass made from spring and summer growth not more than 6-8 in. long; for longer material, cut before it reaches the stage at which it would normally be cut for hay, the data will approximate more closely to those for "very good" hay, and in view of the protection from "weathering" losses afforded to such material by the quick drying, it may reasonably be designated as "super-hay."

If the protein data be first examined it will be seen that they range from about 21 per cent. for the very young grass maintained by continuous close grazing down to $3\frac{1}{2}$ per cent. for very poor hay. Moreover, the fall in this item is very rapid with continued growth, becoming no more than about 9 per cent. in the best early-cut hay. Clearly, therefore, unless a careful note has been made as to the stage of growth of the grass at the time of cutting, any guess at the protein content of the dried produce, whether "dried grass" or "hay," may be very wide of the mark.

The same note of caution applies also to estimates of general nutritive value (energy value) as expressed in the starch-equivalents, although here the range of probable variation is not as great. For maintenance purposes the best dried grass is shown as having about twice the value of the worst hay, and for production purposes about three times the value of the latter. In actual practice the difference in production value will probably be greater than this, as the poor hay will be unpalatable and more wastefully disposed of than the good article. It will be

NOTES ON FEEDING

safer indeed, where the hay is of such poor quality, to regard it as little more than a " filler," no better at any rate than straw, and to place little reliance upon it for covering any appreciable part of the production needs of the stock. Further, the concentrated foods used to supplement it will need to be considerably richer in protein to secure the " balance " of the ration than where good hay is available.

Any distinction between " dried grass " and " hay " is purely conventional, since there is no natural line of demarcation in composition and feeding value between the two products. The classification adopted by the Association of Dried Grass Producers is based upon protein content, with a minimum standard of 12 per cent., above which the material is designated " grass," and below this as " hay."

For feeding practice, however, so simple a standard is hardly adequate, and fibre-content should also be taken into account as a rough guide to the bulkiness and coarseness of the material. From a broad survey of the data given above one might classify as " grass " the material that contains (in its dry matter) not less than about 10 per cent. digestible protein equivalent (or 13 per cent. total protein), and not more than about 25 per cent. of total fibre, with an estimated production starch equivalent of not less than about 55 per cent. The greater the deficiency of protein and starch equivalent, and the higher the excess of fibre from these " standards " the more will the material show the physical and nutritive characteristics associated with the term " hay "—always valuable for maintenance, but steadily losing in production value as it falls away from the " standard."

A large proportion of the 1937 hay crop will be adjudged " good " or " very good " by farmers, but in this connexion one may recall the data published by Watson and Ferguson in an earlier issue of this JOURNAL (Vol. XLIV, p. 247), which seemed to indicate that practical estimates of hay quality tend to be rather optimistic when judged in terms of protein content and starch equivalent. That there should be some such discrepancy is not surprising, since the farmer bases his opinion upon his knowledge of the nature of the herbage and the conditions under which it was harvested, together with the appearance, texture and aroma of the cured hay in the stack; his judgment is thus based primarily upon physical qualities and the known degree of weathering. What he undoubtedly underestimates is the loss of nutritive value that grass may undergo in the course of hay-making, even under favourable

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conditions, and it is, of course, these losses that are revealed by the chemical analysis. These losses even in a good season, may amount to as much as 20 per cent. of the dry substance of the grass; and moreover this 20 per cent. consists of some of the most valuable nutritive matter of the grass, so that the 20 per cent. loss of dry matter becomes over 30 per cent. in terms of starch equivalent, and involves a similar loss of protein. It is certain, therefore, that hay of the composition described as "very good" in the table given above is never very abundant, even in the best of seasons, and that the bulk of the hay commonly described as "good" by the farmer will more often than not rank in composition intermediate between the averages for "good" and "poor" in the table.

The nutritive value of grassland produce is by no means completely depicted in terms of protein, fibre and starch equivalent, since minerals and vitamin-content must also be taken into account. In the table the dry matter of the best young grass is shown as having about twice the mineral content of that of the worst hay. The difference of value is really much greater, since the minerals of young grass consist mainly of soluble, useful minerals, whereas those of hay include a considerable proportion of silica and other insoluble minerals.

From the beginning of ripening onwards some retransferrence of soluble minerals back to the soil takes place, which is accentuated by rain, especially after cutting, so that in badly rain-washed hay the remaining minerals may amount to little more than the insoluble matters of little value.

The proportions of the individual minerals present in the grass are subject to considerable variation according to soil, manuring, rainfall and conditions of growth generally, but, broadly speaking, the ash of grass, and of good hay made from it, are characterized by relative richness in lime and potash, and a fair, but smaller proportion of phosphoric acid. Chlorine (common salt) also is usually well represented as compared with most other foods. Viewed as a whole the ash of grass is basic in character, so that it forms an excellent complement to the ash of concentrated foods, which usually contains an excess of acid elements. This basicity is considerably reduced in grass from acid soil, so that a higher and better mineral content of the herbage is one of the valuable advantages that follows the liming of such soils, even when there is no apparent effect upon the bulk of the herbage. Where grass or good hay from soil well supplied with lime forms a sub-

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stantial part of the ration there should be no need of " mineral supplements," except possibly for the very highest levels of production.

As to vitamin-content, it is now familiar knowledge that the colouring matters of grass include carotene, which is the precursor of vitamin A, and is partly responsible for the yellow colour that grass tends to impart to animal fat, notably milk fat. The carotene and vitamin A of growing grass are largely conserved in the product obtained by rapid artificial drying, but are steadily lost in the process of haymaking, with its prolonged exposure to sunlight and fermentative influences. Whilst dried grass is thus a fairly good source of carotene and vitamin A, the same cannot be said of hay, which at best is a very uncertain, and never a considerable source of these ingredients.

The relative values of the two products are reversed, however, in relation to vitamin D (anti-rickets), since exposure to sunlight tends for a time to increase the amount of this vitamin in the cut grass. Prolonged exposure, accompanied by rain, destroys this advantage, however, along with the general deterioration of the hay.

The farmer who has conserved part of his grass as silage will have a product, if well made, fully equal in nutritive value to the best hay he could have made from the grass as cut, young grass giving a silage relatively rich in protein, and older grass a silage more comparable in the protein content of its dry matter to ordinary hay. It will have the advantage over hay of retaining all the valuable minerals of the grass, and of having also suffered less loss of vitamin A and carotene. It is naturally less concentrated, since it will contain anything from 70 to 80 per cent. of water, as compared with the 15 per cent. or thereabouts of cured hay, but the " succulence " thereby imparted to it is usually accounted to it for virtue.

Because of the relatively high protein-content of young grass it is not easy to make good silage from it by the ordinary method, and the fermentation losses are apt to be high. For such material, therefore, one of the newer methods is usually recommended, either the acid (A.I.V.) process, or the molasses process. Recent tests suggest that the latter, though possibly not quite as efficient as the former in minimizing loss of dry matter, does not fall far short of it, and is better suited to the practical conditions of the farm.

Lastly, we may turn to consider the most natural of all

NOTES ON FEEDING

methods of conserving grassland produce where practicable, that of laying up pastures for winter keep. Data are given in the table for the average value of the herbage available in January on pasture that has been close grazed up to the end of July. Judged by these figures the herbage would appear to have the value of very good hay. This has been confirmed by the results of examination of the changes in chemical composition of the herbage of grazed and ungrazed plots at Cockle Park (Thomas & Boynes, *Empire Journal Exper. Agric.*, Vol. IV, p. 368). Protein content and nutritive value fell in autumn and early winter on grazed and ungrazed plots alike, but rose in the late winter when the grass began to grow again. Judged by chemical composition the nutritive value of the winter grass was inferior to that of summer grass from the same pasture and of the age at which it is normally grazed. The mineral efficiency of the winter grass, however, was relatively high, and "compared favourably in this and other respects with month-old summer grass from inferior Boulder Clay pastures, and with hay from one of the best meadow plots at Cockle Park." The general conclusion may be drawn from these observations, that the practice of laying up grass for winter keep affords a useful means of conservation, which might perhaps be more widely used in districts with moderate conditions of climate.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein. equiv.
Wheat, British.. ..	£ s. 9 3	£ s. 0 9	£ s. 8 14	72	s. d. 2 5	d. 1·29	% 9·6
Barley, Canadian, No. 3 Western	8 17	0 8	8 9	71	2 5	1·29	6·2
" Argentine ..	8 7½	0 8	7 19	71	2 3	1·21	6·2
" Iraqi ..	8 8½	0 8	8 0	71	2 3	1·21	6·2
" Persian ..	8 5½	0 8	7 17	71	2 3	1·21	6·2
" Russian ..	8 18	0 8	8 10	71	2 5	1·29	6·2
Oats, English, white ..	8 17	0 9	8 8	60	2 10	1·52	7·6
" " black and grey	8 10	0 9	8 1	60	2 8	1·43	7·6
" Scotch, white ..	10 0	0 9	9 11	60	3 2	1·70	7·6
" Canadian, No. 2 Western ..	10 13*	0 9	10 4	60	3 5	1·83	7·6
" Canadian, No. 3 Western ..	9 15†	0 9	9 6	60	3 1	1·65	7·6
" Canadian mixed feed ..	9 0	0 9	8 11	60	2 10	1·52	7·6
Maize, Argentine ..	7 2	0 7	6 15	78	1 9	0·94	7·6
" South African, No. 2 White Flat	7 0†	0 7	6 13	78	1 8	0·89	7·6
" South African, No. 4 Yellow	7 0†	0 7	6 13	78	1 8	0·89	
Beans, English, Winter	7 3½	0 17	6 6	66	1 11	1·03	19·7
Peas, English, Blue ..	11 12½	0 15	10 17	69	3 2	1·70	18·1
" Japanese ..	22 5†	0 15	21 10	69	6 3	3·35	18·1
Milling Offals :—							
Bran, British ..	7 7	0 16	6 11	43	3 1	1·65	9·9
" broad ..	7 12	0 16	6 16	43	3 2	1·70	10·0
Middlings, fine, imported ..	8 5	0 13	7 12	69	2 2	1·16	12·1
Weatings† ..	8 7	0 14	7 13	56	2 9	1·47	10·7
" Superfine† ..	8 15	0 13	8 2	69	2 4	1·25	12·1
Pollards, imported ..	7 12	0 14	6 18	50	2 9	1·47	11·0
Meal, barley ..	9 15	0 8	9 7	71	2 8	1·43	6·2
" " grade II	9 0	0 8	8 12	71	2 5	1·29	6·2
" maize ..	7 12	0 7	7 5	78	1 10	0·98	7·6
" " South African ..	6 17	0 7	6 10	78	1 8	0·89	7·6
" " germ ..	7 10	0 11	6 19	84	1 8	0·89	10·3
" locust bean ..	7 15	0 5	7 10	71	2 1	1·12	3·6
" bean ..	9 5	0 17	8 8	66	2 10	1·52	19·7
" fish (white) ..	15 0	2 4	12 16	59	4 4	2·32	53·0
" Soya bean (extracted)† ..	10 0	1 10	8 10	64	2 8	1·43	38·3
Maize, cooked, flaked..	8 2	0 7	7 15	84	1 10	0·98	9·2
Linseed cake—							
English, 12% oil ..	10 7	1 1	9 6	74	2 6	1·34	24·6
" 9% " ..	9 15	1 1	8 14	74	2 4	1·25	24·6
" 8% " ..	9 12	1 1	8 11	74	2 4	1·25	24·6

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein. equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Cottonseed cake, English, Egyptian seed, 4½% oil ..	6 0	0 18	5 2	42	2 5	1·29	17·3
Cottonseed cake, Egyptian, 4½% oil ..	5 15	0 18	4 17	42	2 4	1·25	17·3
Cottonseed cake, decorticated, 7%-8% oil	8 7†	1 9	6 18	68	2 0	1·07	34·7
Cottonseed meal, decorticated, 7%-8% oil	8 5†	1 9	6 16	70	1 11	1·03	36·8
Coconut cake, 10% oil	7 17†	0 18	6 19	77	1 10	0·98	16·4
Ground-nut cake, decorticated, 6-7% oil	9 5*	1 8	7 17	73	2 2	1·16	41·3
Ground-nut cake, im- ported decorticated, 6-7% oil	8 0	1 8	6 12	73	1 10	0·98	41·3
Palm-kernel meal, 1-2% oil	7 0	0 12	6 8	71	1 10	0·98	16·5
Feeding treacle ..	5 0	0 8	4 12	51	1 10	0·98	2·7
Brewers' grain, dried ale	6 7	0 11	5 16	48	2 5	1·29	12·5
Brewers' grains, dried porter	6 0	0 11	5 9	48	2 3	1·21	12·5
Dried sugar-beet pulp..	From £5 os. od. to £5 7s. 6d. per ton, ex-factory (according to factory.)						

* At Bristol.

§ At Hull.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex-mill or store. The prices were current at the end of September, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 1s. per ton as shown above, the cost of food value per ton is £9 19s. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1·43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 3d.; P₂O₅, 2s. 7d.; K₂O, 3s. 6d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6·2	8 11
Maize	78	7·6	7 2
Decorticated ground-nut cake	73	41·3	8 12
„ cotton-seed cake	68	34·7	8 7

(Add 10s. per ton, in each instance, for carriage.)

The cost per unit starch equivalent works out at 2·17 shillings, and per unit protein equivalent 0·70 shilling. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent Per cent.	Protein equivalent Per cent.	Food Value per ton, on farm £ s.
Wheat	72	9·6	8 3
Oats	60	7·6	6 16
Barley	71	6·2	7 18
Potatoes	18	0·8	2 0
Swedes	7	0·7	0 16
Mangolds	7	0·4	0 15
Beans.. .. .	66	19·7	7 17
Good meadow hay	37	4·6	4 4
Good oat straw	20	0·9	2 4
Good clover hay	38	7·0	4 7
Vetch and oat silage	13	1·6	1 9
Barley straw.. ..	23	0·7	2 10
Wheat straw.. ..	13	0·1	1 8
Bean straw	23	1·7	2 11

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d., post free 7d.

MISCELLANEOUS NOTES

The Agricultural Index Number

The general index number of prices of agricultural produce for September is 137 (base September, 1911-13=100), or 4 points higher than a month ago and 10 points above that for September, 1936. If allowance be made for payments under the Wheat Act, 1932, and the Livestock Industry Act, 1937, the revised index for the month becomes 142. The increase in the contract price of liquid milk in September was almost entirely responsible for the rise in the general index. Prices of barley, fat pigs, eggs, butter, cheese and potatoes also showed an advance but those of wheat, oats, fat cattle and sheep and wool were lower than in August.

Monthly index numbers of prices of Agricultural Produce. (Corresponding months of 1911-13 = 100.)

Month.	1932	1933	1934	1935	1936	1937
January	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	140
May	115	102	112	111	115	133
June	111	100	110	111	116	131
July	106	101	114	114	117	131
August	105	105	119	113	119	133
September	104	107	119	120	127	137
October	100	107	114	113	125	—
November	101	109	114	113	125	—
December	103	110	113	114	126	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and for the Cattle Subsidy (b).

Month.	1932	1933	1934	1935	1936	1937
January	—	111	119	124	125	133
February	—	110	117	122	123	133
March	—	106	112	118	122	134
April	—	109	116	126	128	143
May	—	105	116	117	120	136
June	—	104	114	117	121	134
July	—	104	117	120	121	134
August	108	108	122	120	124	136
September	108	111	125	128	133	142
October	104	112	121	119	129	—
November	105	113	120	119	129	—
December	107	114	120	120	130	—

(a) Commenced August, 1932. (b) Commenced September, 1934.

MISCELLANEOUS NOTES

In the following table the monthly index numbers of prices of individual commodities are shown for the months of June to September, 1937, September, 1936, and September, 1935; base, the corresponding months of 1911-13=100.

Commodity.	1937				1936	1935
	Sept.	Aug.	July	June	Sept.	Sept.
Wheat	114	118	120	123	98	64
Barley	147	147	127	129	124	121
Oats	125	125	121	120	98	90
Fat cattle ..	115	119	114	111	98	94
„ sheep ..	138	141	145	152	131	114
Bacon pigs ..	124	120	117	114	111	93
Pork „ ..	125	119	115	113	109	98
Eggs	141	138	144	129	124	119
Poultry	130	132	130	132	113	117
Milk	202	175	175	162	202	215
Butter	109	110	112	109	98	89
Cheese	124	126	128	122	106	78
Potatoes ..	147	127	142	189	149	147
Hay	95	97	95	98	105	95
Wool	146	147	143	138	100	89
Dairy cows ..	117	114	115	115	103	105
Store cattle ..	113	119	120	117	97	88
„ sheep ..	138	142	139	132	132	124
„ pigs ..	153	141	133	127	138	122

Revised index numbers due to payments under the Wheat Act and to the Cattle subsidy.

Wheat	132	124	123	125	132*	121
Fat cattle ..	130	134	128	125	113	109
General Index ..	142	136	134	134	133	128

* Superseding figure previously published.

Grain. At an average of 8s. 7d. per cwt. wheat was 10d. lower on the month, the index moving downwards by 4 points. (If the "deficiency payment" under the Wheat Act, 1932, is taken into account the index is 132.) Barley at 12s 3d. per cwt. showed a rise of 1s. 1d. but oats were reduced by 4d. to 8s. 5d. per cwt. Owing, however, to corresponding movements in the prices of these commodities having occurred during the base years, the indices remain unchanged. In September, 1936, wheat averaged 7s. 4d. per cwt., barley 10s. 4d. and oats 6s. 7d.

Live Stock. Quotations for fat cattle again declined, the average for second quality at 38s. 6d. per live cwt. being 1s. 9d.

MISCELLANEOUS NOTES

less than a month earlier, and the index falls by 4 points to 115. The addition of the subsidy under the Livestock Industry Act, 1937, brings the index to 130. At an average of 10d. per lb. for second quality, fat sheep were lower by $\frac{1}{4}$ d. per lb. and the index is reduced by 3 points. Baconers at 12s. 8d. and porkers at 13s. 7d. per score (20 lb.) advanced in price by 4d. and 1s. respectively, the relative indices being higher by 4 points and 6 points.

Dairy cows and store pigs were dearer than in August, the index for the former moving upwards from 114 to 117 and that for the latter from 141 to 153. On the other hand prices of store cattle and store sheep declined on the month and the respective indices are lower by 6 points and 4 points.

Dairy and Poultry Produce. During the period under review the regional contract price of liquid milk was advanced by 2d. per gallon but, as the seasonal increase in the base period did not take place until October, the current index shows a rise of 27 points to 202. Butter at 1s. 2 $\frac{3}{4}$ d. per lb. averaged $\frac{1}{2}$ d. per lb. more than in August; a corresponding but proportionately greater rise was, however, recorded during the base years and the index is 1 point lower. Price movements of eggs continued upwards, second quality averaging 16s. 10d. per 120, as against 15s. 2d. in August, and the index shows an advance of 3 points. Cheese at £4 9s. 6d. per cwt. was 3s. above last month's figure but, with a somewhat larger increase in the base price, the index is reduced by 2 points. Prices of fowls were unchanged while ducks and geese realized less money, and the combined index for poultry is lower by 2 points.

Other Commodities. The seasonal change from early varieties to main crop, for the purpose of compiling the potato index, resulted in a rise of 20 points in the index which, at 147, is 2 points below that for September, 1936. Quotations for both clover and meadow hay were practically unchanged but, owing to the rise which took place during the corresponding months of 1911-13, the combined index declines by 2 points. Both price and index of wool were slightly lower.

Annual Conferences of Poultry and Dairy Instructors

The annual Conferences of Poultry Instructors and Dairy Instructors arranged by the Ministry took place on October 20 and 21, respectively, at the Middlesex Guildhall, Westminster, London, S.W.1. Both Conferences were opened by Sir

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Donald Fergusson, K.C.B., Permanent Secretary of the Ministry.

At the *Poultry Instructors' Conference*, under the chairmanship of Mr. P. A. Francis, O.B.E., the Ministry's Poultry Commissioner, the subjects discussed and the names of those who read papers and opened the discussions were as follows :—

- | | |
|--|--|
| Value of Pedigree Breeding for Egg Production. | Mr. S. S. Monro, B.Sc.(McGill), M.Sc. (Wisconsin) (Poultry Geneticist for the Canadian Dominion Experimental Farm System).
The discussion was opened by Mr. H. H. Duckett, N.D.P., N.D.A. (Chief County Poultry Instructor, Somerset), followed by Mr. G. M. Robertson (Adviser in Poultry Keeping, Lancashire). |
| The Chief Factors Governing the Financial Results from Poultry Keeping Enterprises under Present-day Conditions. | Mr. D. H. Dinsdale, M.A. (Adviser in Agricultural Economics, King's College, Newcastle).
The discussion was opened by Mr. C. W. Goode, N.D.A., N.D.D. (Lecturer in Poultry Husbandry, Yorkshire), followed by Captain H. M. Leighton (Instructor in Poultry Keeping, Montgomeryshire). |
| Investigations in connexion with Fowl Paralysis. | Mr. F. Blackmore, M.R.C.V.S., D.V.S.M., (Advisory Veterinary Officer Institute of Animal Pathology, Cambridge).
The discussion was opened by Mr. F. H. Jones, N.D.P. (Instructor in Small Live Stock, Nottinghamshire), followed by Mr. O. R. Stevenson, N.D.P. (Adviser in Poultry Keeping, East Sussex). |
| Internal Egg Faults in Relation to Education and Marketing. | Mr. E. T. Halnan, M.A. (Poultry Nutrition Section of the Animal Nutrition Research Institute, Cambridge), and Mr. C. A. Flatt (Senior Marketing Officer, Ministry of Agriculture and Fisheries).
The discussion was opened by Major H. D. Day (County Poultry Instructor East and West Suffolk), followed by Mr. J. B. Morrison (County Poultry Instructor, Bedford). |

The *Dairy Instructors' Conference* was under the chairmanship of Mr. J. Holmes, B.Sc. (Agric.), N.D.D., the Ministry's Senior Inspector in Dairying, and was entirely devoted to dairy education. The subject was introduced by Professor H. D. Kay, O.B.E., Ph.D., D.Sc., Director of the National Institute for Research in Dairying, and part-time consultant

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in Dairying to the Ministry. Some of the principal conclusions reached by him were as follows:—

- (1) There is need for a better training in general science, including biology, in all elementary and secondary schools.
- (2) There is need for specialized training of future dairy farmers and dairymen at farm institutes, agricultural colleges and universities, and urgent need to bridge the educational gap between 14 and 16 years of age.
- (3) There is need for arrangements between dairy training centres and commercial processing plants for instruction on large scale, modern operations.
- (4) There should be a diminution of the variety of courses, with a bias towards longer courses of a more scientific character and properly organized day and evening courses in milk processing, manufacture and control.
- (5) Refresher courses should be instituted for those engaged in the industry and for dairy teachers. There should be interchange of dairy teaching personnel in institutions and colleges.
- (6) There should be greater uniformity of instructional and examination standards.

The following also contributed to the discussion on particular aspects of dairy education:—

Mr. Ben Hinds, Vice-Chairman, Milk Marketing Board.

Mr. E. Capstick, M.C., M.Sc., N.D.D.

Mr. Ben Davies, Director of Laboratories, United Dairies, Ltd.

Professor F. Hall, M.A., B.Com., Education Department, Co-operative Union, Manchester.

Professor J. McGregor, B.Sc., N.D.D., The University, Leeds.

Principal H. G. Robinson, M.Sc., Midland Agricultural College.

Mr. W. B. Mercer, M.C., B.Sc., Reaseheath Farm School, Cheshire.

Miss M. C. Taylor, N.D.D., Cannington Farm Institute, Somerset.

Mr. G. T. Morgan, N.D.D., Welsh Department, Ministry of Agriculture.

Post-Graduate Agricultural Scholarships

The Ministry and the Department of Agriculture for Scotland have revived, in a modified form, the scheme (which was in operation from 1924 to 1931) of post-graduate agricultural scholarships for students who propose to follow the career of agricultural organizer, or instructor, or lecturer in agriculture. The selection of the candidates for this year's awards has been made and scholarships, each of one year's duration, have been awarded to the following:—

James B. Cureton .. King's College, University of Durham.

William Longrigg .. Do.

Parlan J. Macfarlan .. University of Glasgow.

Kenneth N. Russell .. University of Reading.

The object of the scholarships is to broaden the agricultural knowledge and experience of students, and so to qualify them

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for the type of career above mentioned. The successful candidates will be attached for the period of the awards to county and other agricultural educational institutions and advisory centres to enable them to maintain a close contact with the practical side of teaching and advisory work, and to familiarize them with county agricultural education work generally.

County Egg Laying Trials

The main object of the County Egg Laying Trials is to demonstrate the value, from the point of view of egg yield, egg size, seasonality of yield and constitutional vigour, of selected birds as potential breeding stock for egg production. The trials have considerable educational value, both locally and generally. They are conducted under official county auspices in accordance with uniform regulations approved by the Ministry of Agriculture and Fisheries.

In the 1936-37 trials, carried out during the 48 weeks ended September 1 last, 9,148 birds were kept under observation in 40 separate counties. The death rate was 17.7 per cent. as compared with 7 per cent. of 6,450 birds in 1930-31, there having been a steady increase in mortality in the trials in the intervening period.

With regard to the breeds entered in 1936-37, Rhode Island Reds were represented by 4,396 birds (48 per cent. of the total), White Wyandottes by 1,578 birds (17 per cent.), White Leghorns by 1,267 birds (14 per cent.), Light Sussex by 1,241 birds (14 per cent.) and all other breeds by 666 birds (7 per cent.). The average production per bird entered (including production by birds that died) and the mortality of the four principal breeds were as follows:—

			<i>Average Egg Yield per Bird Entered</i>	<i>Mortality per cent.</i>
Rhode Island Reds	..	..	169.46	15.97
White Wyandottes	.	.	163.17	23.83
Light Sussex	..	..	157.32	15.15
White Leghorns	.	..	164.60	20.13

The Gold Challenge Cup presented by the Millers' Mutual Association for award to the county whose laying trials show the lowest mortality among the counties entering the competition, combined with an average egg production per bird entered of not less than 170, has been won in 1936-37 by Cornwall with a mortality of 11.90 per cent. of the birds

MISCELLANEOUS NOTES

entered and an average production of 175.39 eggs per bird. The runners-up were West Wales (mortality 12.75 per cent. and average egg production 170.98) and Northamptonshire (mortality 13.33 per cent. and average egg production 189.63).

In 1937-38 season 39 counties are conducting trials. Those in Middlesex and Lancashire have been abandoned, but in West Sussex, where trials were abandoned last season, they will be resumed in the current season. An increasing number of counties are including a flock testing section in their trials to demonstrate the value of the competitors' breeding stock.

Brood Diseases of Bees

As noted in previous issues of this JOURNAL, investigations into the cause and treatment of brood diseases of bees have been conducted during the past three years by Dr. H. L. A. Tarr at Rothamsted Experimental Station. These investigations have been carried on with funds provided equally by the Government and through the British Beekeepers' Associations.

The results of the first three years researches proved so promising that it was unanimously decided by the Bee Research Advisory Committee at Rothamsted to continue them, if possible, for a further three-year period. The estimated cost is £550 per annum, of which the Agricultural Research Council has promised £300, if £250 can be raised from other sources. In response to an appeal recently issued to beekeepers and beekeeping associations, a sum of £226 has been received for the current year, leaving £24 still to be provided. For the two following years, there is at present only a guaranteed fund of £103 per annum.

The investigations have already thrown light on several important points. Dr. Tarr has shown that European and American Foul Brood are distinct diseases caused by different organisms. He has confirmed that American Foul Brood is due to a bacterium *Bacillus larvae*, and that its incidence is independent of the strength of the colony. European Foul Brood, on the other hand, is a disease of weak stocks, probably caused by *Bacillus pluton*, in association with other organisms. It has also been demonstrated that a third condition known as "Addled Brood" is very prevalent in Britain, constituting approximately a third of the cases of "Foul Brood" sent in for examination. Although apt to be mistaken for Foul Brood, Addled Brood is really due to defective condition in the queen, and when once recognized can readily be cured by requeening.

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The investigations of the next three years will be concentrated on tests of control measures for European and American Foul Brood, and further research will be carried out on the organisms causing European Foul Brood in order that the incidence of this disease may be as well understood as that of other diseases. It is hoped that support will be forthcoming to meet the small amount still required for this years' work, and to enable the investigations to be continued during the three-year period commencing April 1 last. Contributions will be gratefully received by the Secretary, Rothamsted Experimental Station, Harpenden Herts.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

- Devon :** Miss N. M. H. Sonley, N.D.H., N.D.D., has been appointed Instructress in Rural Science *vice* Miss M. W. Earle, N.D.D., C.D.D., B.D.F.D.
- Essex :** Mr. E. A. Gray, M.R.C.V.S., has been appointed Lecturer in Veterinary Hygiene *vice* Mr. E. Macnab, M.R.C.V.S.
- Lancashire :** Mr. J. W. Walker, B.Sc. (Hort.) has been appointed Assistant Instructor in Horticulture *vice* Mr. W. L. Steer.
- Nottinghamshire :** Mr. G. F. Kingston, M.A., has been appointed Assistant Agricultural Organizer *vice* Mr. J. C. Blossom, B.Sc. (Agric.), N.D.A., N.D.D.

MINIMUM RATES OF WAGES

Farm Workers' Minimum Rates of Wages.—A meeting of the Agricultural Wages Board was held at Kings Buildings, Smith Square, London, S.W.1, on September 21, 1937.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders:—

Gloucestershire.—An Order fixing minimum and overtime rates of wages for male workers and minimum rates for female workers, to come into force on September 26, 1937 (i.e., the day following that on which the existing rates expired) and to continue in operation until September 24, 1938. The minimum rates for male workers of 21 years of age and over are as follows: (a) head carters 38s. 6d. (instead of 36s. 6d.) per week of 58 hours in summer except in the weeks in which Good Friday and Whit Monday fall, when the hours are 51, and 40s. (instead of 38s.) per week of 60 hours in winter, except in the week in which Christmas Day falls, when the hours are 52½; (b) head shepherds and head stockmen, 40s. (instead of 38s.) per week of 60 hours, except in the weeks in which Christmas Day, Good Friday and Whit Monday fall, when the hours are 52½; (c) under carters, 36s. (instead of 34s. 6d.) per week of 54 hours in summer, except in the weeks in which Good Friday and Whit Monday fall, when the hours are 48; 38s. (instead of 36s. 6d.) per week of 57 hours in winter, except in the week in which Christmas Day falls, when the hours are 50½; (d) under shepherds and under stockmen, 38s. (instead of 36s. 6d.) per week of 57 hours, except in the weeks in which Christmas Day, Good Friday and Whit Monday fall, when the hours are 50½; and (e) other male workers, 33s. (instead of 32s.) per week of 50 hours in summer, except in the weeks in which Good Friday and Whit Monday fall, when the hours are 41, and 48 hours in winter, except in the week in which Christmas Day falls, when the hours are 39½. Provision is made for an adjustment of the hours in respect of which the minimum rate is payable in the week preceding Whitsun week to meet cases where a holiday is given in that week instead of in the week in which Whit Monday falls. The overtime rates in the case of all male workers are unchanged at 9d. per hour on weekdays and 11d. per hour on Sundays, Christmas Day, Good Friday and Whit Monday. For female workers of 18 years of age and over the rate is 6d. per hour (instead of 5d.) for all time worked.

Oxfordshire.—An Order fixing minimum and overtime rates of wages to come into force on October 4, 1937 (i.e., the day following that on which the existing rates expired) and to continue in operation until October 2, 1938. The minimum rates for male workers of 21 years of age and over are 34s. (instead of 32s. 6d.) per week of 50 hours in summer, except in the weeks in which Good Friday, Easter Monday, Whit Monday and August Bank Holiday fall, when the hours are 41; 48 hours in winter, except in the weeks in which Christmas Day and December 27, 1937, fall, when the hours are 39½. The overtime rates for male workers of 21 years of age and over are unchanged at 10d. per hour on weekdays and 1s. per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and December 27, 1937. The minimum rates in the case of female workers of 18 years of age and over are 7d. per hour (instead of 6½d. per hour), with overtime unchanged at 8d. per hour on weekdays and 9½d. per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and December 27, 1937.

Worcestershire.—An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution to come into operation on September 26, 1937, and to continue in force until

MINIMUM RATES OF WAGES

March 6, 1938. The minimum rates in the case of male workers aged 21 years and over are 33s. (instead of 31s.) per week of 52 hours in summer and 48 hours in winter, except in the week in which Christmas Day falls, when the hours are 39½, and the overtime rate for male workers aged 21 years and over is unchanged at 9d. per hour for all such employment. The minimum rates in the case of female workers of 18 years of age and over are unchanged at 5d. per hour, with overtime on Sundays and in excess of 8 hours on any other day at 5½d. per hour.

Pembroke and Cardigan.—An Order fixing minimum and overtime rates of wages to come into force on October 1, 1937 (i.e., the day following that on which the existing rates expired) and to continue in operation until September 30, 1938. The minimum rates in the case of male workers of 21 years of age and over are 33s. (instead of 31s.) per week of 54 hours in summer, except in the weeks in which Good Friday, Whit Monday and August Bank Holiday fall, when the hours are 46 (instead of 54 hours in any week throughout summer), and 52 hours in winter. The overtime rates for male workers aged 21 years and over are 8½d. per hour on weekdays, Sundays, Christmas Day, Good Friday, Whit Monday and August Bank Holiday (instead of 8d. per hour on weekdays, Sundays and Christmas Day). In the case of female workers of 18 years of age and over the minimum rate is unchanged at 5d. per hour with overtime payment also unchanged on weekdays and Christmas Day at 6d. per hour, and on Sundays at 6½d. per hour for the first three hours and 7½d. per hour for subsequent hours.

Radnor and Brecon.—An Order fixing minimum and overtime rates of wages to come into force on November 1, 1937 (i.e., the day following that on which the existing rates expired) and to continue in operation until April 30, 1938. The minimum rates in the case of male workers of 21 years of age and over are 33s. per week of 48 hours in winter and 54 hours in summer (instead of 32s. per week of 50 hours in winter and 54 hours in summer) with overtime unchanged at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is unchanged at 5d. per hour with overtime also unchanged at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

Enforcement of Minimum Rates of Wages.—During the month ending October 12, 1937, legal proceedings were taken against seven employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow:—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers involved
		£ s. d.	£ s. d.	£ s. d.	
Cornwall..	Camelford ..	1 0 0	—	20 8 5	1
" ..	Penzance ..	2 0 0	—	30 0 0	1
Devon ..	Plympton ..	6 0 0	—	18 18 1	3
Derby ..	Derby ..	1 0 0	—	19 0 0	4
Lancashire	Ashton-				
	under-Lyne	10 0 0	—	37 0 0	1
"	Blackburn ..	4 0 0	—	40 0 0	1
Pembrokeshire	Newport ..	1 0 0	—	26 18 1	1
		25 0 0	—	192 4 7	12

WIRELESS TALKS, NOVEMBER, 1937

AGRICULTURAL

Station and Date	Time : p.m.	Speaker	Subject
National :			
Nov. 3	6.20	Mr. W. S. Mansfield	Farming To-day :— The Ewe Flock.
„ 10	6.20	„ „	Wintering Cattle (with his stockman).
„ 17	6.20	„ „	Systems of Farming (with Dr. R. McG. Carslaw).
„ 24	6.20	„ „	Basic Slag.
North :			
Nov. 12	6.40	—	For Northern Farmers :— A Discussion between a Representative of the Milk Board and a Big Distributor
„ 26	6.40	Prof. J. A. Hanley and another	Land Fertility.
Midland :			
Nov. 4	6.40	Mr. A. Roebuck	For Midland Farmers :— The Imperial Fruit Show.
„ 18	7.55	Miss H. Molyneux	Incubation and Rearing Problems.
West :			
Nov. 1	6.35	Mr. I Orr-Ewing, M.P., and others	Quarterly Meeting of the Federation of West Country Farmers at Long Ashton.
„ 4	6.40	Mr. A. W. Ling and another	For Young Farmers.
„ 11	6.40	Messrs. A. W. Ling and J. B. Passmore	For Western Farmers in particular: Agricultural Machinery.
„ 18	6.0	—	For Young Farmers.
„ 25	8.0	Mr. A. W. Ling and Major Mockett	For Western Farmers: Sugar Beet in the West.
Welsh :			
Nov. 1	8.50	Mr. M. Williams and others.	Llanybyther Fair.
„ 5	8.15	Mr. W. H. Jones and others	For Welsh Farmers only: A Discussion on the Recreational Aspect of Rural Life.
Scottish :			
Nov. 4	6.25	Mr. A. B. Fowler	For Scottish Farmers :— Grass Drying.
„ 11	6.40	Mr. J. Duncan	—
„ 16	6.25	Mr. J. Dickson	A Hill Hirscl
„ 25	6.30	Mr. A. Fraser	—
Northern Ireland :			
Nov. 5	9.45	Mr. I. W. Seaton	Mapping the Way to Higher Yields.
„ 12	7.45	Mr. P. Fitzpatrick	Farmers' Work and Worry.
„ 19	7.30	—	A Discussion on the Fruit Industry.
„ 26	6.30	—	A Young Farmers' Debate.

FOOT-AND-MOUTH DISEASE

HORTICULTURAL

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National :			
Nov. 7	2.0	Mr. C. H. Middleton	Pruning.
" 14	2.0	"	Planting Roses.
" 21	2.0	Messrs. C. H. Middleton and M. C. Allwood	Carnations.
" 28	2.0	Mr. C. H. Middleton	Soils and Manures.
North :			
Nov. 5	7.30	Messrs. W. E. Shewell-Cooper and J. F. Leeming	For Northern Gardeners :— Delphiniums.
" 19	6.40	Messrs. W. E. Shewell-Cooper and J. Thomas	Chrysanthemums.
West :			
Nov. 5	9.25	Messrs. D. Harris and D. van der Wilden	For Western Gardeners :— Bulbs.
" 19	6.45	Messrs. D. Harris and L. D. C. McLees	Seeds

Foot-and-Mouth Disease.—No further outbreak of Foot-and-Mouth Disease was confirmed in the Infected Area which covered parts of the North Riding of Yorkshire and of the County of Durham subsequent to the initial outbreak at Marske on September 12, and, therefore, the area was first contracted to approximately 5 miles radius round the infected premises on September 27 and finally released from restrictions on October 4.

Further outbreaks of disease were confirmed on October 4 at Fairlight, Hastings, East Sussex, and on October 5 at Scamblesby, near Louth, Lincs (Lindsey). The usual restrictions were imposed over areas of approximately 15 miles radius round the respective premises. The areas under restrictions lie in the county of East Sussex and in the county of Lincoln (parts of Lindsey and Kesteven) respectively.

No further outbreaks have been confirmed in either of the Infected Areas referred to in the preceding paragraph, and the areas were contracted to approximately 5 miles round the infected premises of October 19. Provided the disease position remains satisfactory, infected area restrictions will be withdrawn from these Areas on October 26.

The existence of Foot-and-Mouth disease was confirmed at Thurning, Norfolk, on October 16, and at Salhouse, Norfolk, and Worplesdon, Surrey on October 17. The usual restrictions were imposed over a combined area of 15 miles radius round the two infected premises in Norfolk, and 15 miles radius round the infected premises in Surrey. The areas under restriction in consequence of the outbreaks in Norfolk and Surrey lie in the counties of Norfolk and East Suffolk, and in the counties of Surrey, Southampton, Berkshire, Buckinghamshire and Middlesex respectively.

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Principles of Economic Planning. By G. D. H. Cole. Pp. xxiii + 435. (London: Macmillan & Co., Ltd. 1935. Price 6s.)

In this book Mr. Cole's object is to indicate, once again, the defects of the existing planless economic system, to demonstrate that the kind of planning that may be possible under capitalism is not likely to set them right, and to sketch the type of programme that a government resolved to plan for the full utilization of economic resources under a system of substantial equality of incomes ought, in his view, to set before itself.

This is hardly one of Mr. Cole's best books. It is long and ill arranged. The exposure of the vices of planless capitalism is stale and over laboured. There are some errors of fact: The British Wheat Act does not (as stated on page 127) prescribe the use of a minimum quota of British wheat by the milling industry; and the levy which it imposes falls on all flour and not imported flour only (page 171). The argument that Denmark has experienced no hardship from the British bacon quota is hardly substantiated by the figures quoted in support of it (page 154), for these figures relate to total British imports of bacon and hams (including imports from Empire countries), and not those from Denmark alone. The figures relating to Denmark alone, while reflecting a considerable rise in price, nevertheless show a substantial fall in total value. Mr. Cole's economic theory also tends to be dogmatic and slight. His view of the effects of a tariff (p. 267) is strangely confused: "to the extent to which the imposition of a duty raises the home price of the dutiable goods, the tariff begins to lose its effect, for importers can afford to pay the duty out of the higher price." It is, of course, obvious that the possibility of continued importation will ordinarily prevent prices from rising by more than the amount of the duty, but if the foreign supplier pays the duty out of the higher price it is not he at all but the home consumer who, in the last resort, is paying it. In any case it is absurd to argue that a tariff loses its effect in proportion as it raises prices. The matter is of course, complicated by the ease or difficulty with which home production responds to the tariff; but this is a point which Mr. Cole does not mention.

In the last part of the book Mr. Cole outlines the operation of a completely planned economy. This will, he thinks, involve the fixing of a production programme for each industry, based on a forecast of demand; allowance being made for foreign trade (conducted as far as possible by barter) and the forecast of demand being based on knowledge of the planned distribution of incomes. Under the planned economy the greater part of everyone's income is to take the form of a "social dividend" and will not be a payment for work done; but payments for work done will still have to be made on a scale sufficient to provide the necessary incentives to effort. Payments of interest, after a transitional period, will cease altogether. Parliamentary government is assumed to survive in some form, but Mr. Cole is not sure what the form will be. "A planned economy may not be inconsistent with Fascism, but it is plainly inconsistent with capitalist parliamentarism." The transition, however, is assumed to be brought about by constitutional means, for Mr. Cole does not believe that a revolutionary situation exists in Britain.

Mr. Cole believes that the tendency towards restriction of production would not be so strong in agriculture as in other "sectionally planned" (i.e., trustified or cartellized) industries, and he is therefore rather more hopeful of the possibilities of agricultural planning under capitalism than of planning in other industries. Marketing organization he thinks

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is indispensable "as long as the actual production remains in the hands of a large number of separate farmers." Nevertheless, control of imports is also necessary, and this can only be satisfactorily worked by Import Boards. Import quotas alone are too expensive for the consumer and benefit the foreign supplier as well as the home producer. More than these measures, however, will be needed if agricultural planning is to be tackled effectively. Mr. Cole suggests that the land ought to be nationalized and the private landlord eliminated; the State should assume responsibility for providing fixed capital, and should insist on reasonable standards of cultivation. Mr. Cole also favours experimentation—on the lines suggested by Dr. Addison in his proposal for large-scale State farms—in new methods of productive organization. However, "no one in Great Britain proposes that the State should at any early point in the process of socialization take the direct conduct of the greater part of agriculture into its hands."

The Internal Parasites and Parasitic Diseases of Sheep, Their Treatment and Control. By I. C. Ross, D.V.Sc., and H. M. Gordon, B.V.Sc. P. xx + 238; 46 plates and 35 text-figs. (London: Angus and Robertson. 1937. Price 25s.)

It is very fitting that a text-book on the parasitic helminths of sheep should come from Australia, where mutton and wool production hold such an important place in animal husbandry. As the authors point out, there is no more important source of disease and economic loss to the sheep industry throughout the whole of the Commonwealth than that of helminth parasites. They consider that there is ample reason for a publication such as this, treating the subject in a more specialized way than has been done in various recently published text-books, and expounding the association of the parasites with disease in a way that can be appreciated by laymen. It has not been the aim of the authors to teach helminthology to the sheep farmer, however, but only to enable him to obtain as much information as possible from a book that is primarily written for the scientific worker.

The arrangement is the usual one of first giving a description of the morphological characters of each group and species, and following with a detailed account of life histories, epidemiology, methods of control and treatment.

The helminths and helminthiases of Australian sheep receive the fullest attention, but parasites that have not yet been located in Australia are also included. The sections of fascioliasis, parasitic gastritis and nodular disease are particularly full, and there is much interesting information on the diagnosis and pathology of parasitic gastritis caused by the several different species of trichostrongyloid worms in the stomach and intestine. Most, but not all of the observations on this subject tally with experiences in this country, but it is surprising to find that diarrhoea is regarded as an invariable symptom of trichostrongylus infestation, differentiating it from hæmonchosis; the faeces of sheep affected with trichostrongylosis in the recent outbreak in this country were characterized by their hard and dry nature, whereas profuse diarrhoea is usually associated with hæmonchosis. In mentioning the copper sulphate and nicotine sulphate mixture that has been used for some time in South Africa and the United States, and recently tried on an extensive scale in this country, attention is rightly called to the narrow margin of safety between the toxic and the curative dose, and the need for caution.

The text is clearly written and well illustrated by many original and well-chosen drawings and photographs. There are a few typographical errors,

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a reference to the appendix on p. 162 appears to be incorrect, two words are transposed wrongly at the foot of p. 43, and "larva" should read in the plural on p. 80, but these are all that came to the reviewer's notice.

The third section of the book gives a brief account of methods of collecting and preserving parasitic worms and of the diagnosis of helminthic disease. An appendix on the relationship to sheep of the parasites of the natural fauna of Australia, a glossary of the scientific terms (for the use of laymen) and a good index complete a very useful addition to the literature on sheep diseases.

The Journal of the Royal Agricultural Society of England.—Vol. XCVII. Pp. cxlviii + 498. Illus. (London: John Murray. 1936. Price 15s.)

Practical agriculturists as well as research workers will find much useful matter in the current issue of this very old-established annual publication. In addition to the usual official reports and particulars of the Society's activities during the past year, there are special articles on important agricultural subjects. An illustrated article by Mr. R. T. Shears, entitled "Housing the Agricultural Worker," deals with conversion and reconditioning under the Housing (Rural Workers) Act. Messrs. R. McG. Carslaw and C. Culpin write on "Labour, Power and Equipment in Arable Farming," Mr. M. Griffith on the Cahn Hill experiments in improvement of hill grazings, and Dr. E. M. Crowther on "The Technique of Modern Field Experiments," continuing the story told by Mr. G. E. Fussell in a previous issue of the same journal. A useful paper on the troublesome sheep tick (*Ixodes ricinus*) and methods of control, is contributed by Mr. W. Lyle Stewart. Two illustrated articles by Mr. W. S. Mansfield and Professor J. A. Scott Watson deal with the Cambridge University Farm, and Mr. Clyde Higgs' Dairy Farms respectively, and readers will agree that the descriptive caption, "Notable Farming Enterprises," is well deserved. Professor R. Rae writes on "Systems of Housing for Pigs," and Mr. R. S. Langford follows with a review of "Changes in Beef Imports before and after the Ottawa Agreement." It may be fairly claimed that this old-established publication is indispensable for those who desire to keep abreast of the latest developments in scientific agriculture.

Electrification of Agriculture and Rural Districts. By E. W. Golding, M.Sc.Tech., A.M.I.E.E., Mem. A.I.E.E. Pp. xii + 244. (London: The English Universities Press, Ltd. 1937. Price 16s.)

This is one of a series of works on electrical engineering being published by the English Universities Press. It is divided into three sections, the first being a general review from the economic and social aspect, the second describing the actual applications of electricity to agriculture and rural work, and the third dealing with the purely electrical aspect. Mr. Golding has therefore covered every aspect of his subject with some thoroughness.

From the point of view of the farmer and the farmer's wife, Part II would be the most interesting section. This deals with the practical uses of electricity for lighting, heating and domestic work, and generally for providing power for farm jobs and in relation to horticultural operations. The information provided is quite comprehensive and detailed. It describes such things as electric cookers in detail, stating their cost and the economies and advantages of their use, while from the information supplied, the charges for running them at local rates can be readily calculated.

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Sufficient has already been written about the application of electric power to farm operations to give every reader of this *Journal* a good idea of the variety of ways in which this source of power can be adapted for farm work. Mr. Golding's detailed description of the available apparatus and of its use on the farm is as adequate as is that of its use in the farmhouse.

The general discussion with which the book opens will undoubtedly meet with some criticism. Few people are in entire agreement on any general question relating to farming, and Mr. Golding has dared to take a definite standpoint, although he admits in his preface that all that he has done is to attempt to present a fair review of the whole question in so far as this is possible by one in the electrical engineering profession.

World Consumption of Wool, 1936. A Supplement to "Wool Intelligence Notes," prepared in the Intelligence Branch of the Imperial Economic Committee. Pp. 126. (London: His Majesty's Stationery Office. 1937. Price 2s. 6d.)

The latest issue of the Imperial Economic Committee's annual review of wool textile activity in the chief manufacturing countries not only gives a general picture of the position and trends during the year 1936, but also, in the majority of its tables, enables comparisons to be made with previous years from 1930.

The improvement in the demand for wool, which began in 1935, continued progressively in 1936, the United Kingdom, Belgium, Poland and the United States of America being mainly responsible for increased imports of raw wool. Imports into France were much reduced, owing, it is suggested, to general industrial conditions, and to a shrinkage in exports of the processed article. Germany and Italy suffered from a shortage of supplies, owing to their inability to find sufficient foreign exchange for imports of wool, while in Japan activity was somewhat hampered, in the latter half of the year, as a result of the trade dispute with Australia. The United States, which had for some time been working out its domestic stocks, bought largely in both Australia and South America in the latter part of 1936.

Prices showed moderate fluctuations early in the year, but latterly a definite upward trend was in evidence. The rise was most marked in the lower qualities of crossbred wools, and one reason suggested for this was the utilization of these grades in goods for Coronation decoration. Statistical appendices provide useful information regarding world production of, and trade in, raw wool, and wool tops, yarns and tissues.

Orchard and Small Fruit Culture. By E. C. Auchter and H. B. Knapp. 3rd Edition. Pp. xxi + 627, and 278 Figs. (New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd. 1937. Price 25s.)

This book was written in 1929 and revised in 1932. In this new edition the work of revision has centred on bibliographical and statistical material. The conditions described are such as prevail in different parts of the United States of America, but the general principles of fruit production are the same the world over.

The chapter on harvesting, storing and marketing is particularly valuable, the sound advice given being supported by many statistical tables showing where apples are produced, proportions of different grades due to the variety and the grower, causes of low grades, storage holdings in different months and seasons, price tendencies, exports, etc. Marketing and the reasons for successes and failures in co-operative enterprises are considered.

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The chapter on establishing the orchard is also supported by statistics showing apple regions and varieties, effect of soil on grades, and increasing or decreasing popularity of varieties. In dealing with nutrition, the absence of response to potash applications under their climatic conditions is striking in comparison with the marked results obtained in this country. The chapters on fruit production describe good practice similar to our own, but more attention is given to the management of orchard soils, including the use of mulch and cover crops to maintain organic matter—a point that does not always receive the attention that it needs in this country.

It is curious that the only method of exhibiting apples mentioned is on plates, in view of the popularity of commercial fruit shows here. The production of small fruits is only briefly mentioned. A valuable feature of this book in addition to the statistical tables already mentioned, is the long lists of books, bulletins, circulars and scientific papers, with dates of publication, given at the close of each chapter.

Über Abschreibungen und Wertungen im Landwirtschaftlichen Betrieb (*Depreciation and Evaluation in Agriculture*). By G. Klauder, Ph.D. Pp. 87. (Berlin: Paul Parey, 28-29 Hedemannstrasse. 1937. Price RM.6.20.)

In this brochure, Dr. Klauder discusses the relation between writing-off and the actual business of the farm, and how it has the effect of a distribution of expenditure, but not of a simple statement of the position regarded solely from the viewpoint of capital. A critical examination of the various forms of procedure for writing-off, shows that some are well adapted to wear and tear, consumption, etc., while others are inconvenient to manage. The discussion is necessarily technical, but it will repay study by the economist who is interested in the business management of the farm.

Egg Prices: A Study of the Factors Affecting Prices and Production.—By O. J. Beilby. Pp. 66. (Oxford: Agricultural Economics Research Institute, Parks Road. 1937. Price 2s. 6d.)

The post-war expansion of the poultry industry reached its highest point in 1934, since when there has been a gradual decline in the number of birds kept on holdings of over one acre. To a considerable extent this decline is due to unfavourable prices in relation to production costs, especially evident in the abnormally low egg prices prevalent during last winter. Mr. Beilby's study of egg prices makes its appearance at a critical juncture in the history of poultry-keeping. He deals with the various problems in an able and impartial manner, and gives a clear and concise explanation of the causes of price fluctuations and the influence of the chief factors affecting egg prices, viz., demand, home supplies and imports.

The policy of import restriction so strongly advocated by certain sections of the industry is not considered by the author to be an effective means of ensuring an immediate return to better prospects for poultry-keepers, the decline of prices being attributed mainly to larger home supplies. It is stated that 66 per cent of the price changes between one year and another is due to home production, 19 per cent. to changes in demand and only 5 per cent. to changes in imports. The general conclusion is that to achieve even a slight improvement in prices the cut in imports would have to be so disproportionately great that the adoption of such a policy would be almost impracticable. Other important facts connected with poultry-keeping are discussed, while the report also gives details

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of the changes in home production, in imports and the countries from which they come, the changes in feeding stuff prices and the increase in mortality rates. This brochure should assist to an understanding of some of the problems that confront the poultry industry.

World Trade and Its Future. By Sir Arthur Salter. Pp. 101. (Philadelphia: University of Pennsylvania Press; London: Humphrey Milford. 1936. Price 7s. 6d.)

This book consists of a reprint of five lectures given by Sir Arthur Salter at Swarthmore College in the spring of 1936. After briefly describing the characteristics of world trade as it was carried on before the Great War, Sir Arthur surveys developments during the post-war period and the depression, and concludes with a final lecture entitled "A policy for world trade in the future." Among the fundamental economic conditions of the present time perhaps the most important is the changing trend of population growth. This has freed the western world from the fear of food shortage, but we are confronted with an immense problem of transfer. "There must be a large movement from the land into industry, the distributive trades and into personal services of all kinds." At the same time the adjustment of production to demand is likely to be a much more difficult matter than during the period of expansion in the nineteenth century.

Writing before the tripartite currency agreement of last year, Sir Arthur gives first place among his practical proposals to a removal of uncertainties as to the relative value of currencies by some form of provisional stabilization, possibly leading to the re-establishment of a gold standard, a development which he inclines to favour. He nevertheless makes it clear that the gold standard must be purged of its abuses, and in particular that Central Banks must co-operate to prevent wide variations in the general level of gold prices. Foreign investment he thinks will remain at a lower level than in the pre-depression period, though it may rise again in the not distant future. As regards the removal of tariffs and other trade impediments, Sir Arthur believes that progress is most likely to be made as a result of an examination by each country of its import policy on the basis of a clear conception of its national policy as a whole. Proposals could then be prepared for the removal of anomalies and the encouragement of imports of the types favoured by the national policy; and these would provide the basis for negotiation with other countries. Such negotiations, however, should be bilateral or plurilateral rather than universal; and for successful negotiation under these conditions Sir Arthur believes a modification of the most-favoured-nation clause to be desirable so as to permit the formation of low-tariff groups of countries whose mutual concessions need not necessarily be extended to the outside world. The Ouchy Convention of 1932, and the resolutions of the Montevideo Conference of 1933, are quoted as models.

Sir Arthur's is an eminently realistic outlook, progressive but free from doctrinaire attachment to unattainable ideals. It is well summed up in his concluding sentence: "We must, I suggest, regard our present economic nationalism not simply as an enemy we have to slay but as the possible parent—with proper encouragement and education—of a better system than itself."

Laying Battery Management. By H. E. Sweptstone. Pp. 16. (London *The Feathered World*, 1936. Price 6d.)

Intensive methods of commercial egg farming offer many advantages to the poultry-keeper who, in these days of keen competition and low prices, is compelled to give very careful consideration to all the factors

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that control costs of production, and there is an urgent need for the information contained in this practical little booklet. The subject is dealt with in as concise a manner as possible, and only essential and practical information is given within the restricted limits imposed by a publication of this size. The illustrations and letter-press are of undoubted practical value, and the booklet should find a wide circulation among poultry-keepers.

Deserts on the March. By Paul B. Sears. Pp. 231. (Norman: University of Oklahoma Press, New York; Simon and Schuster. 1937. Price \$2.50.)

In 1798, the Rev. T. R. Malthus published his remarkable "Essay on the Principle of Population," in which he demonstrated conclusively the tendency, recognized by certain earlier philosophers, for population to increase to the point of pressure on the means of subsistence. The great colonization of the nineteenth century and the agricultural possibilities opened up by the introduction of artificial fertilizers furnished an apparent answer to Malthus' alarmist theories. In recent years, however, the supposedly infinite horizon has suddenly shrunk, and the world to-day can see the limit of its agricultural possibilities. In no country has the realization of a limit to natural resources been more forcible than in the United States, and Professor Sears' book is one of several recent works on the subject of soil wastage and soil conservation.

"Deserts on the March" is a remarkable study of the impact of man on nature. When the colonist arrives in a virgin land he intrudes on a long-established equilibrium. How disastrous to the soil this intrusion may be is shown by examples from China, India and Egypt. The author's main theme is the story of the pillage of the soil resources of the United States by the white settlers. It is interesting to note that he considers the British to have been more reckless in spoliation than the German and Dutch colonists, who brought with them to the New World a tradition of conservative agriculture.

The essential facts of the tragic story are well known—exhaustive cultivation resulting in loss of humus, deterioration of soil structure, erosion, and ruin. Erosion affects the river systems, burdening them with silt, whereby their beds are dangerously raised in their lower reaches. The removal of the natural cover and the exposure of unabsorptive sub-soil increases the frequency and severity of floods. During recent years, the disastrous dust storms in the West have also shown that arable cultivation has been pushed too far in the direction of the desert.

Professor Sears, whilst painting in vivid colours the tragic picture of pillage and waste, believes that the situation may yet be saved. His solution of the problem goes deeper than the technical methods of soil conservation. Whilst stressing the need for more technical knowledge he pleads for an increased sense of responsibility for the natural resources of the nation. He also urges national action, possibly through taxation, to encourage good and discourage bad management.

The destruction and waste that have gone on in the United States have, happily, not occurred in our own country. In spite of Professor Sears' strictures on the British colonist, the farmer at home has not had the opportunity to be other than conservative in his methods. Yet the principles underlying soil conservation and the possible dangers of reckless exploitation should be familiar to everyone interested in agriculture, above all to those connected in any way with the utilization of the land of our Empire overseas, to much of which Professor Sears' arguments are directly applicable.

"Deserts on the March" may be strongly recommended. The author,

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a master of his subject, tells his story vigorously and dramatically." That it has reached a third printing in the year of publication is sufficient evidence of its success in the author's own country.

Grass Drying. By E. J. Roberts, M.A., M.Sc. Agricultural Research Council. Report No. 11. Pp. 125, 14 figs. and map. (London: His Majesty's Stationery Office. 1937. Price 2s.)

Grass Drying. By S. W. Cheveley, M.Sc. Pp. 127, and 9 figs. (London: Ivor Nicholson & Watson, Ltd. 1937. Price 6s.)

The literature of grass drying grows apace, and it is inevitable that among the numerous publications in this, the initial stages of the process, very much the same material should be found. It is in the manner of presentation that the greatest differences arise, and the greatest difference between these two works is that the second is the work of an enthusiast and the first is that of an unbiased investigator. Mr. Cheveley is apparently convinced about grass drying, but it may be suspected that he expresses his opinions too confidently. It has not yet been proved, for instance, that dried grass will do all and even more than can be done with cakes.

Mr. Roberts' work was undertaken for the Agricultural Research Council, and he visited most of the grass drying outfits in this country and travelled abroad to investigate them in other countries. His book, as is indicated above, contains very much the same material as that of Mr. Cheveley, but the material is presented with more caution. Both books deal extensively with the available machinery for drying, with the management of grass land for drying, and with the apparatus required to enable young short grass to be cut. Either of them forms a valuable introduction to the subject, and if the two are read in conjunction with the Oxford Agricultural Research Institute Bulletin reviewed in this *Journal* for June, anyone who is interested in the subject will obtain a complete review of present knowledge on the subject.

Plant Ecology. By Hilda Drabble. Pp. 142 & 24 Figs. (London: Edward Arnold & Co. 1937. Price 7s. 6d.)

The teaching of "Nature Study" in schools and colleges is now largely replaced by Ecology, which, on a more scientific basis deals with the "home-life" of animals and plants, their relationships one to another, and their grouping into communities. There has therefore arisen a need for text-books of several standards. The present work is an adequate presentation of the chief environmental factors that influence the ecological distribution of plants in Britain, followed by accounts of the chief plant-communities. The subject is carried approximately to the Intermediate, or nearly to the Pass, B.Sc. standard of London University, but no scheme of practical or field-work is suggested, except in a meagre epilogue. This is unfortunate, for it would be a grave mistake in botanical education if plant ecology were to develop as a cramming subject. It should be made impossible to answer ecological questions except on the basis of personal observations and experiments. If used as a guide to the type of research the student can carry out in woodlands, grass land, marshes, and by the coast, Mrs. Drabble's book should fulfil a useful purpose. The accounts of the plant communities are concise, accurate, and written in a clear unambiguous style. The importance of autecological studies and experiment is neglected and the work is essentially limited to synecology. As a text-book of plant-ecology it is therefore incomplete. Twelve excellent double plates, mostly from photographs taken by Professor E. J. Salisbury, illustrate typical plant communities. A short bibliography and a list of test questions is given.

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Jefferies' England: Nature Essays. By Richard Jefferies. Ed. by Samuel J. Looker. Pp. xxxvii + 356, and 24 figs. (London: Constable. 1937. Price 8s. 6d.)

The recrudescence of a literature sentimentalising over the countryside reveals the artificiality of the Augustan age, when Watteau shepherdesses, Gay's poems and other examples of a truly urban appreciation of a rustic holiday were multitude. The last decade, because we can print more speedily and forget more rapidly, has seen the issue of a vast quantity of work of this genre. In these circumstances it would have been profoundly astonishing if the more descriptive essays written by Richard Jefferies had not been gathered together and reprinted. It was an obvious thing to do and two editors have come forward with such a production.

Samuel J. Looker's "Jefferies' England" is a selection of essays, of a particular type, made from five volumes of miscellaneous essays. They define, according to the editor, the latest and most developed period of Jefferies' life and thought, but many people would be inclined to join issue with him. The beauty of these descriptive passages cannot be denied, and indeed no one would wish to deny it: but description of nature, saturated as it may be with a mystical philosophy whose definitions are none too clear, is no more than a pleasant pastime for a naturalist of the quality of Jefferies.

Other work that he did is likely to be of far more permanent value. In such works as "Hodge and his Masters" and "Toilers of the Field" he has placed on record the conditions of life of human beings in the countryside, and has used all the great artifice he possessed to dramatize these living people. Incidentally, he fills in a background of the environment in which they lived, so that we see both the people and the country.

Of course, this is a question of taste. For some the way of living of mankind is the one thing they find of interest; for others these details abstract all their pleasure in field and hedgerow. To these last "Jefferies' England" will be a source of unflinching enjoyment.

Growth Hormones in Plants. By P. Boysen Jensen. Translated by G. S. Avery and P. R. Burkholder. Pp. xiv + 268, 64 figs. and 17 tables. (London: McGraw-Hill Publishing Co., Ltd. 1936. Price 21s.)

Although the idea of growth-promoting and growth-retarding substances in plants was suggested by the early botanists, and accepted by Darwin, it was not until 1910 that the *hormone* concept, with all that it implies, was applied to plants by Fitting; but such has been the rapidity of advance of this once controversial subject that to-day plant hormones can be extracted, analysed and even crystallized; and their action can be measured and predicted with an exactitude comparable to that associated with any other compound occurring in the plant.

No comprehensive review of this vast new field of experimental biology was available until Boysen-Jensen, who has himself contributed much of the important experimentation on the subject, published his book entitled *Die Wuchsstoffe und ihre Bedeutung für die Analyse des Wachstums und der Wachstumsbewegungen der Pflanzen*, which presented a complete historical review of the subject. An English translation of this classic is greatly to be welcomed, especially as it has been the occasion of a revision of the original text and an extension of the field to cover the literature published during 1935.

All the main contributions to the subject of growth substances (*Wuchsstoffe*) in plants are reviewed, critically but without undue bias. From this review we learn the technique of the investigations on which conclusions are based, and many interesting facts about the behaviour

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of the growth substances. Minute quantities of these substances when present in plant stems stimulate growth, so that unilateral application in sensitive organs such as the *Avena* coleoptile brings about curvature, the degree of which can be used as a measure of the amount of hormone present.

The growth hormone occurring in different plants is the same, and identical substances (auxin) have been extracted from a variety of other sources, both plant and animal. They have been prepared in a crystalline condition and their chemical composition and structure have been determined. Three compounds have been found to possess the hormone properties, and are referred to as auxin *a*, auxin *b* and 3-indole acetic acid (heterauxin). Various other compounds possess similar properties, though to an inferior degree.

The transport of the growth hormones is a matter of great interest. In living tissue they move only in a basi-petal direction and independently of concentration, so that they are capable of moving along a gradient, from a lower to a higher concentration; this capacity can be reversibly abolished by anaesthesia. The rate of transport is too rapid to be accounted for by diffusion, though they can also be transported in the transpiration stream through the dead cells of the xylem.

A further curious fact, showing that the action of the growth substances is intimately bound up with the vital processes of the plant, is that roots are in all respects opposite in their reaction to stems, root growth being inhibited rather than promoted by the presence of the same hormones that are essential for stem growth. The growth of axillary buds is also retarded by a substance produced by the terminal bud and there is every indication that this is the ordinary growth substance. Phototropic movements are accompanied by a differential distribution of the growth substance within the illuminated organ and a similar unequal distribution of the growth hormone is observed when a plant is placed horizontally and undergoes geotropic movements. The hormone is the same in both shoots and roots, only the reactions of the tissue in the two organs being opposite. These observations have greatly added to the difficulty of finding a satisfactory explanation of the action of the plant hormones and no very definite conclusion has yet been reached as to their mechanism. There are indications in certain experiments, however, that the substance is actually consumed during growth, and not merely catalytic in action. Some authors have attempted to associate the movement with differences in electrical potential and it has been observed that the substance tends to move towards a region that is electropositive.

Another effect of the growth substances, and one that may have immense practical importance, is their action upon cell division and cambial activity; thus the presence of hormone stimulates callus formation and root development, and may even bring about the occurrence of this in plants that normally form little or no callus. When this is so the rooting of cuttings may be promoted, so that propagation by this means becomes possible in plants that are otherwise not capable of vegetative propagation. One can foresee many practical developments on these lines by the appropriate use of plant hormones, and more than one firm is now marketing preparations of this nature for which great claims are made.

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Royal Veterinary College and Hospital

On November 9, the King, accompanied by the Queen, opened the new buildings of the Royal Veterinary College. Their Majesties were attended by the Minister of Agriculture and were received at the College by the Duke of Gloucester, President of the College, Lord Crewe, Senior Vice-President, and Sir Merrik Burrell, Chairman of the Council. Sir Merrik Burrell read an address to the King as follows:—

“ MAY IT PLEASE YOUR MAJESTY,

“ The Court and Council of the Royal Veterinary College gratefully acknowledge the signal honour conferred on every one connected with the college, and, indeed, on the veterinary profession as a whole, by your Majesty in graciously consenting to open these new buildings and by her Majesty the Queen in being present with your Majesty.

“ These buildings replace old buildings erected in 1791, during the reign of King George III. In all probability, his Majesty took a personal interest in the efforts of the then Duke of Northumberland and other gentlemen to raise the funds necessary to create the first veterinary college in Great Britain, for, a few years before that time, as Elector of Hanover, he himself founded the Hanover Veterinary School.

“ The college is fortunate in the possession of portraits of King George III and Queen Charlotte, and will be even more fortunate when it possesses the portrait for which your Majesty has so kindly undertaken to sit, and which is to be painted by Mr. Philip de Laszlo,* and most generously

* The Ministry regrets to record the death of Mr. de Laszlo on November 22.

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presented by him to the college in memory of your Majesty's presence here to-day.

" The college has had the honour of continuous Royal patronage since 1830, and received its first Royal Charter in 1875; this was re-granted in a revised form in 1936. His Royal Highness the Duke of Connaught was its president from 1904 to 1932, when His Royal Highness the Duke of Gloucester honoured us by succeeding him. Some 14 years ago, the old buildings had become so out-of-date, so inadequate, and so dilapidated, that it was resolved to demolish them completely and to rebuild on the same site, with additional adjoining land—the whole purchased from the Ecclesiastical Commissioners. The wisdom of the governors' decision was confirmed by a Departmental Committee.*

" The governors have had a very hard task in trying to collect the necessary funds, but with the assistance of a grant of £150,000 from the Government and with the help of many generous subscribers a sum of £285,000 has become available. A further sum of £40,000 is still needed to build the large animal hospital and operating theatre, so completing the building scheme, and to provide the full scientific equipment of the college.

" We are confident that the opening of these new buildings will open wide also the doors of a new era in the history of the veterinary profession in this country."

The King accepted the address and, in reply, said:—

" I thank you sincerely for your address. The Queen and I are very glad to be here to-day, as we are deeply interested in the prosperity of the livestock industry in this country. Indeed, the well-being of the whole community depends largely on the health of our domestic animals being cared for by a highly-trained veterinary profession.

" The value of the annual output of food from animal sources amounts to over £170,000,000, but there is a very considerable wastage through disease. This serious economic loss to the country can be greatly reduced, thanks to the rapid advance of science in recent years; even so, further

* The Committee was appointed by the Minister of Agriculture in 1928 and was under the Chairmanship of Sir C. J. Martin, C.M.G., M.B., D.Sc., F.R.S.

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research is continually needed to extend the methods of cure and—what is still more important—the prevention of disease.

“ My Government is taking steps to form a national veterinary service, through which to conduct a vigorous attack on animal diseases on a national scale; but successful research, wise administration, and efficient practice all depend on the sound education of the individual.

“ It is, therefore, very gratifying that, with financial assistance from both public and private sources, the former board of governors of the Royal Veterinary College should have been able to reconstruct it on modern lines. I trust that the funds necessary for the completion of the hospital will be forthcoming shortly.

“ In declaring the new buildings of the college open, I should like to congratulate Major Maule, the architect, on the splendid result he has achieved, and to express the hope that the important work which lies before the new court, council, and staff may be successfully accomplished.”

Farmers are well aware of the importance to agriculture of this development in veterinary education. The new Veterinary College building accommodates teaching departments of medicine, anatomy, pathology and physiology; a general assembly and lecture hall to seat 300; four lecture theatres, each seating 100; the students' library, refectory, and kitchen; men and women students' and staff common rooms; and a residential flat for the Principal.

Each department includes small private laboratories for individual research by the staffs, and there is accommodation for post-graduate teaching and research work by visitors from other centres at home or abroad. The building also houses a department of preventive medicine.

The Research Institute in Animal Pathology was built in 1924, and is connected to the main college block by a wing containing a large pathological teaching museum, with animal quarters below. The various hospital quarters, with operating theatres, include the Beaumont Animals' Hospital (a free clinic founded a few years ago for the treatment of animals owned by poor people), the canine hospital, and the animal husbandry department with a small model dairy.

At the present time the College has 367 students. State assistance in respect of the educational work carried on was given from 1795 to 1815, and has been renewed since 1907.

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Agriculture Act, 1937: Part IV (Diseases of Animals)

In the note on this subject in the last issue of this JOURNAL (pp. 725-731) it was stated that the date provisionally fixed for Part IV of the Agriculture Act, 1937, to come into operation is January 1, 1938, but that in view of the large amount of preliminary work necessary it was not then possible for a definite announcement to be made on the subject. The question has been further considered and it has been decided to adopt the procedure outlined in the following circular letter which was addressed to local authorities on November 12. It will be noted that the Minister expects to be in a position on April 1, 1938, to assume responsibility for the functions to be transferred, and that it is accordingly proposed that Part IV of the Act should come into operation on that date.

November 12, 1937.

CIRCULAR LETTER ADDRESSED BY THE SECRETARY OF THE MINISTRY OF AGRICULTURE AND FISHERIES TO LOCAL AUTHORITIES CONCERNED IN THE APPLICATION OF PART IV (DISEASES OF ANIMALS) OF THE AGRICULTURE ACT, 1937

SIR,

1. I am directed by the Minister of Agriculture and Fisheries to refer to the Circular Letter addressed to local authorities on the 28th July last on the subject of the transfer of veterinary functions under Section 19 of the Agriculture Act, 1937, and to express his cordial appreciation of the manner in which the Questionnaires enclosed therewith were completed by local authorities. The information thus furnished has proved invaluable to the Minister in formulating the initial plans for the transfer of personnel and functions contemplated by the Act.

2. The Minister is now in a position to indicate to local authorities, in broad outline, his proposals for the field organization of the State Veterinary Service, and the procedure to be followed with a view to effecting the smooth transfer of functions on the "appointed day."

Field Organization of State Veterinary Service

3. Great Britain will be divided into 78 Divisions, each in charge of a Divisional Inspector, and Divisions will be grouped into Areas, each in charge of a Superintending Inspector. Each Division will, in most cases, consist of a single administrative county, but in some a group of counties, in which the volume of work would not justify the employment of more than one Inspector of Divisional rank, will form a Division. Each Division will include the county and other boroughs (or burghs) geographically situated therein which are separate local authorities for the purpose of the Diseases of Animals Acts. The Divisions and Areas will be distributed as follows:—

				<i>Divisions</i>	<i>Areas</i>
England	45	13
Wales	13	2
Scotland	20	7
				—	—
Total	78	22
				—	—

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It is contemplated that in each Division there will be a Divisional Office, situated wherever possible in the county town within easy access of the County Council Offices. A list of the Divisions, with the proposed location of the Divisional Office, is enclosed. In cases in which a County Veterinary Department is at present housed in a part of the County Offices, or in a separate building in the vicinity, the Minister hopes that it may be possible for the Council concerned to let the accommodation for use by the Ministry as a Divisional Office, if only as a temporary arrangement pending provision of permanent accommodation if necessary elsewhere. In this connexion I am to say that H.M. Office of Works have been asked to make the necessary arrangements for the provision of Divisional Offices, and that Department will be communicating at an early date with the County Councils concerned.

Procedure in Regard to the Transfer of Functions

4. If the transfer of functions is to be effected smoothly on the "appointed day" it is very desirable that the "key" men in the new organization, i.e., the Superintending Inspectors and the Divisional Inspectors, shall be appointed and in position before that date. It is proposed, therefore, to proceed forthwith with the appointment of three senior men in local authorities' service (two in England and Wales and one in Scotland), and thereafter with the selection and appointment of Superintending and Divisional Inspectors. It is hoped that local authorities will allow those of their senior men who are offered these appointments to accept the posts and take up their duties with the Ministry so that they can proceed to make arrangements in their respective Areas and Divisions for the transfer of functions on the "appointed day."

Wherever possible a local authority officer appointed as Superintending Inspector will be allocated to an Area including his old county. Similarly, a local authority officer appointed as Divisional Inspector will, wherever possible, be allowed to remain in his old county. There must, of course, be exceptions, but in a large number of cases the ex-county veterinary officer, although technically responsible to the Ministry and charged with a wider range of duties, will be available to advise the junior staff in carrying out the functions of the local authority until the "appointed day."

The remaining veterinary staff, if they have applied for and been offered appointments under the Ministry, will be transferred to the Ministry's service with functions as from the "appointed day."

Date of Operation of Part IV of the Agriculture Act, 1937

5. It will be appreciated that the process of selection, appointment and allocation of the Superintending and Divisional Inspectors will take some little time, and that the setting up of Divisional Offices in 78 cities and towns throughout the country alone represents a task that would be difficult to complete by the date originally contemplated as the "appointed day" for the purposes of Part IV of the Act, viz., 1st January, 1938. It is clear that the transfer must be a gradual process, culminating in the formal transfer of functions and the remaining local authority staff on the "appointed day." After full consideration of all the circumstances, it has been decided to defer the date of operation of Part IV of the Agriculture Act, 1937, to the 1st April, 1938. No order under Section 34 (3) of the Act in this respect will be made at present, but the Minister confidently expects to be in a position on that date to assume responsibility for the functions to be transferred.

6. A further Circular Letter will be addressed to local authorities as soon as possible dealing with other matters at present under consideration in connexion with the transfer of functions.

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7. I am to add that the arrangements outlined in this letter have been discussed with representatives of the County Councils' Association and the Association of Municipal Corporations, in England and Wales, and of the Association of County Councils in Scotland, the Convention of Royal Burghs, and the Association of Councils of Counties or Cities in Scotland, who expressed general approval of the Minister's proposals.

I am, Sir,

Your obedient Servant,

(Signed) DONALD FERGUSSON.

Interesting Birds: (10) The Lapwing

The Lapwing, Peewit or Green Plover is a handsome and conspicuous bird, well known to country folk generally. It is one of the most useful of all our birds and is now rigidly protected in most districts.

The Lapwing eats large numbers of insects and other pests. Although it takes a good many earthworms, it also destroys snails, slugs, wireworms, beetles, and the larvae of insects such as the Crane-fly, Turnip and Cabbage Moths, and Yellow Underwing, which prey upon the roots of grass, turnips, cabbages and cereals. The Lapwing is also of service to the sheep-rearer, as it eats water-snails that harbour the immature form of the liver-fluke, which causes liver-rot in sheep.

The Lapwing breeds in April and sometimes even in March. Its nest is a mere shallow hole or depression in the ground. Quite often it is scooped out and rounded by the bird, but sometimes it is nothing more than a natural hollow or the imprint of a horse's hoof. It is lined with roots, rushes, grasses or other vegetable matter. The eggs are nearly always four in number. Like the eggs of other plovers they are pear-shaped, and are arranged by the bird so that the points of the small ends meet in the centre. This facilitates even sitting and easy covering by the bird. The eggs are very handsome, and vary in ground colour from greenish-olive to pale ochre and even light blue-grey. As a rule they are heavily blotched and spotted with black.

The hen Lapwing is noted for its trick of luring away an intruder by shamming injury, flapping along with one wing trailing as if broken, or stumbling about in an endeavour to attract an unwanted visitor away from the young.

The Lapwing renders great service to agriculture and is well worthy of the title "The Farmers' Friend." Apart from the fact that the bird and its eggs are protected by law, there is no justification whatever for molesting so beneficial a species.



Photograph Copyright by Eric J. Hocking

Lapwing approaching Nest

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Oxford Farming Conference

In view of the interest aroused by the two previous Conferences, it has been decided to establish the Oxford Farming Conference as an annual event, to be held under the joint auspices of the School of Rural Economy, the Agricultural Research Institute and the Institute for Research in Agricultural Engineering.

The earlier Conferences were confined to mechanized farming, but it has been decided that in the future this occasion shall provide a common meeting ground for farmers, research workers and others, at which any subjects of particular interest to British agriculture may be discussed.

The next Conference will be held on January 4-7, 1938, and will deal mainly with the maintenance of fertility, with special reference to the Government's agricultural policy and to the control of weeds and pests.

Further particulars and the detailed programme will shortly be available from the Conference Secretary, 10, Parks Road, Oxford.

Coronation Planting Committee: A Record for the King

The Coronation Planting Committee are preparing a Record of tree planting and amenity schemes, both public and private, organized in commemoration of the Coronation in Great Britain and in overseas Empire countries. The Record will be presented to His Majesty by the Queen, as Patroness of the Coronation Planting Committee. By permission of the King, the volume will later be reproduced in a form suitable for purchase by local authorities, libraries, museums, institutions and interested individuals.

Details of some two thousand planting and amenity schemes undertaken by local authorities and other public bodies, including Coronation Committees, troops of Boy Scouts and Girl Guides, Women's Institutes and by private individuals in the United Kingdom, have already reached the Committee. Information has also been received of planting on a considerable scale in the Dominions and Colonies and of several notable schemes from the United States of America.

For the assistance of the compilers of the Record, those who have been responsible for any type of Coronation memorial are asked to forward detailed particulars, on a special form, which may be obtained from the Honorary Secretary, Corona-

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tion Planting Committee, 68, Victoria Street, Westminster, S.W.1.

Much Coronation planting is expected to take place just now. The Committee are particularly anxious to know of any planting or other amenity schemes which have been held over until the present season as well as those which were dedicated earlier in the year; and they very much desire to receive the information urgently, so that the Royal Record may be presented early in 1938.

Imported Poultry and Eggs

In consequence of the fact that in a number of instances poultry and eggs for hatching have recently been brought from abroad, in apparent ignorance of the regulations which govern the importation of such products, a Press notice calling attention to the provisions of the Poultry and Hatching Eggs (Importation) Order of 1936 was issued by the Ministry at the end of October. The notice was in the following terms:—

The special attention of all poultry-keepers, particularly those who may import poultry and hatching eggs from abroad, is drawn to the requirements of the Poultry and Hatching Eggs (Importation) Order of 1936, which controls the importation of poultry and of eggs intended for hatching. Failure to comply with these requirements, which are briefly indicated below, renders the responsible persons liable not only to great inconvenience and expense, owing to difficulties and delay in delivery of the birds or eggs, but also to heavy penalties for infringements of the law.

This Order, which has been in force since the beginning of the current year, prohibits the landing in Great Britain of *live domestic fowls, turkeys, geese and ducks*, if they have been brought from any country other than Ireland, the Channel Islands or the Isle of Man, unless their landing has been authorized by special licence previously obtained from the Ministry of Agriculture and Fisheries, or, for consignments of poultry (other than geese) not exceeding 21 birds, unless they are accompanied by a veterinary certificate of the prescribed kind. The Order also prohibits the landing in Great Britain from any other country except Ireland, the Channel Islands, or the Isle of Man, of *day-old chicks of domestic fowls or the eggs of domestic fowls intended for hatching*, unless the chicks or eggs, as the case may be, are accompanied by a veterinary certificate. The veterinary

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certificates required for both poultry and hatching eggs must be signed by authorized officers of the Government of the country of origin. Certificates issued by other veterinary surgeons will not be acceptable.

Copies of the Order—which contains specimens of the veterinary certificates required—and any other information regarding this Order, may be obtained from the Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

Appointment of the Livestock Advisory Committee

The Livestock Industry Act, 1937, provides for the constitution of a Livestock Advisory Committee, with Sub-Committees for England, Scotland and Wales, for the purpose of giving advice and assistance to the Livestock Commission in the discharge of their functions. The Act further provides that the Committee shall consist of representative members and four additional independent members; and that the representative members shall be persons appointed as representing respectively the interests of—

- (a) persons carrying on in the United Kingdom the business of keeping live stock,
- (b) local authorities in Great Britain,
- (c) persons carrying on in Great Britain the business of effecting sales of live stock by auction,

and such other interests concerned in the marketing, or preparation for sale, of live stock or products of the slaughtering of live stock as appear to the Ministers to be immediately affected, or likely to be immediately affected, by the operation of the Act.

After consultation with such bodies as appeared to them to be representative of the various interests concerned, the Minister of Agriculture and Fisheries, the Secretary of State for Scotland and the Secretary of State for the Home Department have appointed the following to be members of the *Livestock Advisory Committee*:

Chairman :

Sir John Chancellor, G.C.M.G., G.C.V.O., D.S.O.

Other Independent Members :

Sir Francis Boys, K.B.E.

Sir Robert Greig, M.C., LL.D., D.Sc.

R. N. Jones, Esq.

Representatives of Livestock Producers in the United Kingdom :

P. F. Astill, Esq., J.P.

T. G. Clement, Esq.

W. Graham, Esq.

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W. J. Hyndman, Esq.
 C. T. Joice, Esq.
 J. A. D. Pirie, Esq.
 J. O. Steed, Esq.
 T. Williams, Esq.
 J. R. Wood, Esq., J.P.

Representatives of Local Authorities in Great Britain :

Lt.-Col. Sir Merrik Burrell, Bt., C.B.E.
 A. Chadwick, Esq.
 J. H. Dickson, Esq.
 R. W. Hastings, Esq.
 E. A. Hornsby, Esq.
 Professor J. T. Share Jones, M.D. (V.h.c.), D.V.Sc.,
 M.Sc., F.R.C.V.S.
 Lord Provost Robert Nimmo.
 Captain R. J. Thomson.
 Lt.-Col. C. W. Whitaker, M.A.

Representatives of Livestock Auctioneers in Great Britain :

H. F. Finn-Kelcey, Esq., F.S.I., F.A.I.
 D. S. Hutcheson, Esq., F.A.I.
 F. A. Lloyd, Esq., F.A.I.
 Major R. M. Woolley, F.S.I., F.A.I.

Representatives of other interests concerned in the marketing or preparation for sale of live stock and products of the slaughtering of live stock :

Rt. Hon. A. V. Alexander, M.P.
 A. A. Bonner, Esq.
 C. A. Coggan, Esq.
 G. H. Collinge, Esq., O.B.E.
 R. Duncalfe, Esq.
 T. H. Gill, Esq.
 W. R. Hunter, Esq.
 G. D. Pool, Esq.
 A. Welsh, Esq.
 R. Wood, Esq.

The Livestock Commission have appointed Mr. R. Ross, M.B.E., to be Secretary of the Committee.

The Minister of Agriculture and Fisheries has appointed the following to be members of the *English Sub-Committee* of the Advisory Committee :—

Sir Francis Boys, K.B.E. (<i>Chairman</i>).	Γ. H. Gill, Esq.
Rt. Hon. A. V. Alexander, M.P.	R. W. Hastings, Esq.
P. F. Astill, Esq., J.P.	E. A. Hornsby, Esq.
A. A. Bonner, Esq.	C. T. Joice, Esq.
Lt.-Col. Sir Merrik Burrell, Bt., C.B.E.	G. D. Pool, Esq.
A. Chadwick, Esq.	S. O. Ratcliff, Esq.
C. A. Coggan, Esq.	J. O. Steed, Esq.
G. H. Collinge, Esq., O.B.E.	J. H. Walter, Esq., F.A.L.P.A.
J. H. Dickson, Esq.	Lt.-Col. C. W. Whitaker, M.A.
R. Duncalfe, Esq.	T. Williams, Esq.
H. F. Finn-Kelcey, Esq., F.S.I., F.A.I.	J. R. Wood, Esq., J.P.
	R. Wood, Esq.
	Major R. M. Woolley.

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The Secretary of State for Scotland has appointed the following to be members of the *Scottish Sub-Committee* of the Advisory Committee :—

Sir Robert Greig, M.C., LL.D., D.Sc. (*Chairman*).
 D. Brown, Esq.
 T. G. Clement, Esq.
 W. Graham, Esq.
 W. R. Hunter, Esq.
 D. S. Hutcheson, Esq.
 Lord Provost Robert Nimmo.
 J. A. D. Pirie, Esq.
 J. A. Sinclair, Esq.
 Captain R. J. Thomson.
 A. Welsh, Esq.

The *Welsh Sub-Committee* will be constituted shortly.

The first meeting of the main Advisory Committee and of the English Sub-Committee took place on October 28.

Pigs in England and Wales: 1935 to 1937

The following statement compares the estimated numbers of pigs on farms in England and Wales on September 4, 1937, with the corresponding figures in June and December of the past three years :

		1935	1936	1937
		(thousands)	(thousands)	(thousands)
Sows for breeding	{ June	494	483	455
	{ September ..	—	—	472
	{ December ..	507	480	—
Boars for service	{ June	40	34	32
	{ September ..	—	—	33
	{ December ..	41	34	—
Other pigs, two months and over	{ June	2,074	2,187	2,107
	{ September ..	—	—	2,628
	{ December ..	2,519	2,580	—
Under two months	{ June	1,205	1,100	1,038
	{ September ..	—	—	1,223
	{ December ..	1,046	962	—
TOTAL	{ June	3,813	3,804	3,632
	{ September ..	—	—	4,356
	{ December ..	4,113	4,056	—

Although an inquiry on a voluntary basis has been carried out in December of each of the past two years this is the first occasion upon which the Ministry has obtained figures of the pig population in September. There are accordingly

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no corresponding figures (for this month in previous years) that can be used for comparison with the figures now obtained. The increase in the number of sows since June of this year is similar to the increase between June and December in 1935, and that increase was followed by a sharp decrease by the following June. Similarly, there was a relatively small decrease between June and December last year, but a much greater decrease six months later.

Other pigs of 2 months and over increased by about 400,000 or more between June and December in each of the past two years, although the figures in the following June declined, and the increase of 500,000 between June and September this year may similarly be of a seasonal nature.

Forms of inquiry were sent out to all occupiers of agricultural holdings over one acre in extent, numbering about 370,000, and the above figures were estimated from the returns received from over 270,000. The information will be of value in estimating the supplies of pork and bacon during the next few months, and it will gain in value when comparable figures become available from the inquiries that the Ministry of Agriculture proposes to undertake quarterly in future.

Numbers of Turkeys

The Ministry announces that as a result of an inquiry on September 4, the number of turkeys on agricultural holdings in England and Wales on that date is provisionally estimated at 975,000, compared with 683,000 on June 4. The increase of 290,000 consists mainly of young turkeys hatched since June 4, and represents an additional supply for the Christmas trade.

Until a few years ago, the hatching season for turkeys in this country was nearly over by the time the June 4 returns were collected, and the increase now shown between June and September is evidence of the manner in which farmers have set themselves to cater for the Christmas demand for small turkeys, a demand formerly met almost wholly by supplies from the Continent.

IMPERIAL FRUIT SHOW; 1937

J. TURNBULL,

Ministry of Agriculture and Fisheries

During the last few years it may well have been thought that the leading exhibitors had so nearly reached perfection in the presentation of their fruit that further advance was impossible, but the appearance of the leading exhibits at the Imperial Fruit Show at Birmingham this year showed a definite advance on anything previously seen. The points on the score cards can hardly show this, as there is a natural tendency to mark down from the best exhibits in the particular show. Many years ago one or two exhibits were awarded full marks, but they would probably not have received more than 94 or 95 per cent. this year. Examples of outstanding merit in this show were Mr. Gaskain's King Edwards, which gained $97\frac{1}{2}$ marks in the British Empire class, $96\frac{1}{2}$ in the 22-box class and $98\frac{1}{2}$ in the 4-box class. Then there were Mr. T. Neame's pears, Conference in half-boxes $98\frac{1}{2}$, and in trays 97, Fertility $98\frac{1}{2}$, and Glou Morceau 98 in half-boxes and Comice 98 in trays. Such scores were not confined to the old hands, as Mr. S. B. M. Bremner, almost a newcomer, was awarded 97 for his winning exhibit of Cox's Orange Pippin in trays. Many more exhibits scored between 96 and 97 per cent., some of these gaining no better than third prize, so it will be seen what a very high standard has been reached.

The larger classes attract the greater attention, and in the British Empire section Messrs. W. Seabrook and Sons' 10 boxes of Worcester Pearmain and Mr. Gaskain's 10 boxes of King Edwards stood out above the other entries in their respective classes, by reason of their very bright and attractive colours, and were superb examples of showmanship. Unfortunately, there was no Canadian entry this year, owing to the early date of the show. In the 22 half-boxes of any dessert variety Mr. H. Mount's very bright Cox's were better than Mr. Seabrook's Worcesters and both were well in front of the other entries. In the 22 boxes of any culinary variety Mr. W. F. Gaskain won easily with his King Edwards, though Mr. Seabrook's Monarchs were a good second. In the tray classes Mr. S. B. M. Bremner won in the United Kingdom

IMPERIAL FRUIT SHOW, 1937

Championship section, but was defeated by the Rt. Hon. D. Lloyd George in the United Kingdom section, the winning exhibits in each section being outstanding for their wonderful colour and finish, their fine grading and exceptional neatness in packing. In the 4-box classes the prizes were well distributed. In the Championship section, Mr. H. Mount won the Cox's and Newtons, Dr. Fox, a newcomer, won the Ellisons, Mr. F. Scott the Superb, and Hoveton Fruit Farm the Worcester (both recent additions to the list of exhibitors), Mr. W. Brice won the Bramleys, Messrs. W. C. Chandler the Lanes, and the Eardiston Farming Co. the 3 half-barrels Bramleys. All of these exhibits showed wonderful colour and skin finish in the fruit, and were well ahead in their packing.

In the United Kingdom section, from which previous first prize winners were excluded, there were also some very fine exhibits, the first prizes generally receiving 93 to 95 per cent. of the marks and the seconds 90 per cent. or more. Glewstone Plantations did particularly well, winning with Cox's Superb, Newtons and Lanes, all being outstanding for their colour and packing. In this section in particular there was a larger number of newcomers than usual, and this augurs well for the future of the show. Most of them had realized the need for clean fruit, and some had evidently studied the very high standard of packing required before entering. There were a few instances where there was too much disease and pest marking, generally scab or tortrix caterpillar, some in which packing was not quite up to show standard, and a few that seemed to show no idea of any kind of packing at all. It is to be hoped that the very detailed marking set down on the score cards will enable them to see where they have fallen short. Every exhibitor must make a beginning, and it is only by continual striving and attention to detail that success can be achieved.

Empire Apple Packing Competition. A new feature of the Imperial Fruit Show this year was the Empire Apple Packing Competition, open to packers selected to represent the United Kingdom and any Dominion or Colony. There were four competitors, two representing the United Kingdom, one Canada and one New Zealand. The competition aroused the keenest interest amongst the general public, who crowded into each session, as well as amongst fruitgrowers, who were able to compare the methods of the different countries.

IMPERIAL FRUIT SHOW, 1937

Each competitor had to pack 3 boxes of apples twice a day throughout the show, though for various reasons the boxes packed on the first and last days of the show were not included in the competition. The prizes offered were £20 and a gold medal, £10, £5, and £4. In addition, each competitor received a certificate.

Every session brought crowds of the general public who, though quite unfamiliar with the technique, watched the packers with close interest, and evidently recognizing that each packer was an artist at her work, rewarded them with acclamation. The stop clocks, devised by Mr. J. Stoddart of the Ministry, made timing easy and were closely watched by the public. The competitors, judges and all who assisted in running the competition, are to be congratulated on the happy air in which it was conducted.

It may be imagined that judging such a competition, in view of the very great differences in the ideals of those brought from all quarters of the globe, was a matter of great difficulty, involving the sacrifice of something by both sides. Mr. J. M. Jephson of the Department of the Canadian Fruit Trade Commissioner and Mr. W. H. Barker of the Ministry of Agriculture and Fisheries were the judges and proved equal to the task. At the beginning they discussed the points of principle that arose, with the writer acting as Chairman of Judges. The method adopted was extremely laborious, but it was essential to put the verdict beyond dispute. The fact that their decisions have been recognized by the competitors as just is sufficient testimony to the care and fair-mindedness with which they carried out their duties.

In the score card used, 67 marks were allotted for quality of pack and 33 for time, a total of 100 marks for each pack of 3 boxes, or 1,200 in all. While speed was desired, the marks were intended to ensure that it was not gained at the expense of quality of pack. When the competitors are all so good, as shown by the very high marks awarded, it is hard to have to place them in order of merit, but this is what the judges had to do and the awards were:—

1. Mrs. Stillingfleet, Canada	..	..	..	1,068
2. Mrs. Delves, United Kingdom	..	..	..	1,008
3. Mrs. Tong	..	..	..	996
4. Miss Ballantyne, New Zealand	..	..	..	984

The average times per box were 3 min. 11½ sec., 4 min. 10 sec., and 4 min. 6 sec., respectively, each box containing 175

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apples. Mrs. Stillingfleet was awarded 6 per cent. more than Mrs. Delves on time and 1 per cent. less on quality of pack. When not being judged for quality of pack, Mrs. Stillingfleet averaged under $2\frac{3}{4}$ min. per box, and Mrs. Delves under $3\frac{1}{4}$ min., and even then the packs were far above the ordinary commercial pack for quality.

Mrs. Stillingfleet was undoubtedly the fastest packer and is heartily to be congratulated. She hails from Kelowna, British Columbia, and was chosen after a series of eliminating competitions had been held. Though she had not previously packed in public, she has trained new packers for some years and is herself capable of packing 150 boxes a day. She is a worthy representative of her country.

Mrs. Delves of East Peckham, Kent, and Mrs. Tong of Boughton, Kent, were chosen from among 22 entries by 3 judges, who visited the farms. They have both demonstrated on the Ministry's stand for some years and are well known to English fruit-growers. They have acquitted themselves well on behalf of the United Kingdom and need not be disappointed, when they consider how much more they were called upon to do.

Miss Ballantyne, the daughter of a New Zealand fruit-grower, happened to be in this country and agreed to represent New Zealand. Her service should not be judged by her position on the list. She is to be congratulated on her courage in entering at all, as she had no means of knowing how she stood in regard to other packers, either here, or at home. Her entry added very greatly to the general interest in the competition and made it a truly Empire one.

PRODUCTION OF BROCCOLI IN WEST CORNWALL

J. J. MACGREGOR, M.Sc., B.Sc.

Among the new features that mark the agriculture of recent years, the general farmer's excursions into more specialized practice have received frequent notice. Of such excursions is the production of market garden crops. The reasons for this development vary with the local conditions. For example, it may be that the prices realizable for alternative crops offer more scope; that costs may be cut by mass production; that surplus crops may be used as food for animals; that a careful study of demand may show that it is possible to replace imports excluded by specific duties; and that the farmer may make fuller use of certain types of soil and take advantage of a beneficial climate.

The following article seeks to analyse broadly the effect of such factors as are applicable to the husbandry of West Cornwall, and in particular to indicate the economic effect of such fiscal changes as might be expected to be advantageous to the area.

While it is realized that specific changes may exert an influence on the husbandry of a district as a whole, a review of the effect on one particular crop allows the concrete examination of economic theories on production and marketing from observations based on practice and financial results. Broccoli cultivation in West Cornwall represents a good example for such an analysis because of the concrete evidence available to measure the effect of fiscal and other stimuli.

(1) West Cornwall is readily isolated as an "exporting" area; (2) because of the distance from the main markets the traffic practically all goes by railway, thus making it possible to obtain adequate statistics of monthly trade; (3) the cauliflower crop grown for export to other parts of the United Kingdom is almost entirely of the winter variety, so that official data on "cauliflower and broccoli" acreage can be more strictly related to one crop than it can in other counties, such as Kent, which produces also for the summer market; (4) there is a long tradition of broccoli growing on a double-cropping system with early potatoes, marking a very intensive

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and highly specialized culture in the Penzance and Gulval districts. In some ways, even as regards Cornwall, the available data are subject to definite limitations and qualifications, but nevertheless a rough measurement of recent developments may be found by examining some of the factors at work—among which is the important fact that in recent years many outlying extensive farms in the area have been turning to broccoli growing as a sideline.

Acreage under Broccoli and Cauliflower. The Annual Statistics of the Ministry of Agriculture show that the area of cauliflower and broccoli in the chief growing counties is as follows, and that there has been a noticeable tendency in Kent and Cornwall to increase the area:—

TABLE I
CHIEF COUNTIES GROWING CAULIFLOWER AND BROCCOLI*

	1928 acs	1929 acs	1930 acs	1931 acs	1932 acs	1933 acs.	1934 acs.	1935 acs.
England and Wales ..	13,478	13,863	14,557	15,783	17,671	20,695	20,107	19,538
Cornwall ..	1,555	1,735	2,176	2,599	3,463	3,409	3,517	3,367
Devon ..	123	118	118	135	182	305	317	372
Bedford ..	499	393	433	438	424	706	430	496
Essex ..	430	522	436	460	489	779	626	504
Kent ..	2,739	2,908	3,071	3,228	3,860	4,758	4,267	4,326
Lancaster ..	797	773	897	986	998	1,096	1,436	1,295
Stafford ..	397	424	465	501	469	518	597	596
Worcester ..	523	535	462	564	565	870	635	636
York, W.R. ..	915	981	1,091	1,028	939	1,074	1,187	1,173

* It happens that on June 4, when these returns are collected, some of the land in Cornwall is still under another crop, and therefore there is a tendency to under-estimate the total area grown there, but how far this applies to other counties is not known, although in Lincs, where the broccoli area runs to a big acreage, most of this is under potatoes at June 4. In any event the winter variety is usually planted out before the middle of July. Since 1931, according to the June 4 returns, the counties of Gloucester, Hampshire, Lincoln (Holland), Norfolk, Nottingham and Warwick have all also shown significant areas, which exceeded some of the areas shown in the above table.

Production and Marketing Costs. The writer, when a member of the Economics Branch at Seale-Hayne College, made a survey† of some of the conditions of producing and marketing the crop, and from carefully prepared estimates of about 36 growers found that it was a costly crop to grow.

† Cost of Growing Broccoli in Devon and Cornwall, 1932-33, Farmers' Report No. 7.

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Indeed, the average estimates exceeded £21 for growing costs alone, and, although this included items not demanding a direct cash outlay, such as farmyard manure, which may have exaggerated the high cost, the cost of other items may be accepted. Of this growing cost over 40 per cent. was for manures (for it is considered necessary to manure heavily with "mixed dressing" of pile manure composed of well-rotted humus, seaweed, etc., in addition to artificials); about 20 per cent. for man labour; slightly less than 20 per cent. for rents; and about 10 per cent. for horse labour.

While a few growers sold the crop standing, the customary practice was to prepare it for the distant markets, and this implied cutting, grading, packing, wire and crates, etc. There is considerable evidence that the high charges involved and the expansion of production have stimulated better production and grading and have even led to planned production, i.e., timing the crop. Crates are now almost universally used in place of the old coir nets, and although they are non-returnable (and cost about 7d.) it was believed that the outlay was well repaid by the enhanced price of an attractively packed crop. From the estimates it was found that the average cost of preparing for market was about £16 per acre. The actual figures are shown in the following table:—

TABLE II

Cost per acre of Preparing Broccoli for Market, 1932-33

	£	s.	d.	Per cent.
1. Wire, labels, etc	1	0	3	6.4
2. Crates	9	3	0	58.0
3. Cutting, grading and packing labour	4	3	11	26.5
4. Carting . horse labour ..	0	4	2	1.3
5. Road charges	1	4	6	7.8

£15 15 10

In following the costs a stage further to include transport and marketing at the wholesale markets, such as Covent Garden, only a few detailed estimates were made available, since most of the growers sold through a commission agent who deducted these charges from the gross price. From the estimates it was found that these costs were well over £20, as shown in Table III, although the average total cost of marketing for 12 other growers was £28 13s. :—

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TABLE III

Cost per acre of Transport and Marketing of Broccoli, 1932-33

	£	s.	d.	Per cent.
1. Rail charges	15	16	9	68.0
2. Portage and market tolls ..	2	7	3	10.2
3. Sellers' commission	5	1	11	21.8
	£23	5	11	100.0

Altogether these costs approximate to £60 per acre, and have to be covered by the wholesale price before a profit remains to the grower. Indeed the estimates of 12 of the growers indicated that their average total cost was just over £60.

For this particular reason it was extremely difficult to form an adequate idea of the returns to the grower, as during the season the price was subject to violent fluctuations even from day to day, so that in the absence of well-kept records it was impossible for the producer to give any reliable estimate. Of the production, however, it is possible to get a fairly adequate idea of the total number of plants grown and cut. Twenty-four growers planted an average of 8,600 plants and cut for sale 6,800—a number that would represent about 320 crates.

Prices: Trend and Seasonality. Adequate data on prices are difficult to obtain. The Ministry of Agriculture Statistics quote the seasonal average wholesale price of fruit and vegetables compiled from the Agricultural Market Report, which is published weekly. The price quotations for Cornish Broccoli are obtained from Birmingham, Bristol, Hull, Leeds, Liverpool, London, Manchester, and Newcastle-on-Tyne. The following table shows the seasonal average so obtained.

TABLE IV

*Season's Average Price of Cornish Broccoli :
per crate*

	1924	1925	1926	1927	1928	1929
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1st quality ..	13 6	11 3	9 5	9 10	14 3	12 6
2nd „ ..	10 3	8 8	7 1	6 11	11 6	9 11
	<i>per doz.</i>					
	1929	1930	1931	1932	1933	1934
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1st quality ..	4 5	3 11	3 6	4 0	3 1	4 0
2nd „ ..	3 5	3 0	2 9	3 2	2 4	3 0

As the crop is subject to frequent price fluctuations throughout the growing season it is difficult to get any adequate idea of individual growers' returns but it is possible to get a closer idea from the weekly quotations in the London market, the

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most important market for Cornwall, as reported in the Market Report of the Ministry of Agriculture and as shown here.

TABLE V

Weekly Price for 2-doz. crate of 1st Quality Cornish Broccoli as Percentage of First Week for the First 18 weeks of the year at London for years 1922-24 and 1931-36

Year	Average Price 18 weeks	Price 1st week shillings	Weeks				
			1st %	2nd %	3rd %	4th %	5th %
1922	.. 21.0	22.0	100	100	100	100	109
1923	.. 9.5	10.0	100	100	100	100	100
1924	.. 15.9	15.0	100	100	83	67	67
1931	.. 6.8	6.0	100	116	108	108	100
1932	.. 7.8	7.0	100	86	86	86	100
1933	.. 5.9	3.5	100	129	143	286	229
1934	.. 10.0	14.0	100	100	72	72	72
1935	.. 6.8	5.0	100	120	160	160	120
1936	.. 9.5	10.0	100	90	100	100	100
Average Relative Price			100	105	106	120	111

Year	Weeks						
	6th %	7th %	8th %	9th %	10th %	11th %	12th %
1922	.. 98	82	82	82	73	91	82
1923	.. 100	100	100	100	80	80	80
1924	.. 94	97	100	94	200	200	94
1931	.. 100	100	108	116	116	133	150
1932	.. 150	128	128	128	115	115	100
1933	.. 229	172	172	229	200	143	143
1934	.. 64	64	72	86	79	79	79
1935	.. 120	140	140	120	120	140	180
1936	.. 90	80	80	90	100	120	80

Average Rel- ative Price ..	116	107	109	116	120	122	119
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Year							
	13th %	14th %	15th %	16th %	17th %	18th %	
1922	.. 91	100	109	114	100	109	
1923	.. 80	80	90	100	120	100	
1924	.. 87	94	70	147	120	94	
1931	.. 100	125	116	116	116	116	
1932	.. 86	115	115	121	128	115	
1933	.. 172	158	129	114	172	143	
1934	.. 72	64	57	57	50	50	
1935	.. 140	120	140	160	140	120	
1936	.. 90	60	70	120	120	120	

Average Relative Price	102	102	100	117	113	107	
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The figures indicate the price per crate relative to the first week of the year in 1922-24 and 1931-36. The years in between

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the two periods do not give continuous quotations at Covent Garden. (Percentage figures are used in order to discount the effect on the average of extreme price variations in the different years. There are obvious difficulties in using this method of presentation, especially as the first week of the year does not correspond to the first week of the broccoli season; but it should be possible, on closer examination, to estimate the extreme price variation if so desired.)

Although it may be questioned whether the number of years is sufficient to show a definite seasonal trend, it appears that two periods of higher prices and two periods of lower prices occur in the first 18 weeks of the year. The first period of higher prices would appear to commence about the 4th week, or about the end of January and is prolonged, with fluctuations, until about the 12th week or into the third week of March. There is a less distinct period of higher prices almost at the end of April, and in between is a low price period that compares with that of January. It would appear that the peak of production occurring in March and April is responsible for the low prices at this time. Some correlation may be drawn between these relative price figures and those for production in Table VI.

As was pointed out in the above report, accurate information about the home production of broccoli and the prices ruling at the main markets are very difficult to assess. It was stated* that " in 1925 the production of cauliflower and broccoli in England and Wales was estimated at 162,000 tons, with a value of £1,680,000. In 1931 the acreage under these crops had increased by about one-third. Of the total home-grown supplies, it is estimated that less than 15 per cent. represented broccoli.

In the same year 1931, importation of cauliflower and broccoli into the United Kingdom amounted to about 44,000 tons, worth at least £400,000. In addition, the value of cauliflower in brine probably amounted to a further £100,000.

As regards the fresh vegetables, it is probable that over 80 per cent. is imported during the period October to April, inclusive.

Home-grown supplies of broccoli are chiefly obtained from Cornwall and Kent, the peak periods of production are usually March and April respectively. Supplies, however, from these

* Ministry of Agriculture and Fisheries (The Marketing of Cauliflower and Broccoli, Marketing Leaflet No. 35, October, 1932)

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centres, although on the increase, are no larger than the imports."

A reliable indication of the seasonality of the production in West Cornwall can be obtained from the following figures prepared from data kindly supplied by the Great Western Railway Company. More than half of the normal production occurs in March and April—the latter month generally showing the greater output.

TABLE VI
AVERAGE MONTHLY RAIL TRAFFIC IN BROCCOLI FOR THE
EIGHT SEASONS, 1928-29 TO 1935-36

Season	As Percentage of Total Season Traffic									Production (Season 1928-29=100)
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1928-29 ..	—	1.4	3.8	2.3	2.2	8.7	20.5	43.3	17.8	100
1929-30 ..	—	2.3	2.6	3.1	4.7	4.3	20.1	40.9	22.0	112
1930-31 ..	—	2.2	2.7	5.0	5.7	17.0	28.2	27.1	12.1	104
1931-32 ..	—	1.4	7.5	7.8	10.5	9.0	20.4	29.4	14.0	123
1932-33 ..	—	0.2	1.0	7.2	7.3	17.5	35.5	22.7	8.6	150
1933-34 ..	0.1	0.4	0.8	0.8	6.1	6.4	23.5	49.0	12.9	183
1934-35 ..	0.3	2.0	4.3	15.4	12.9	16.1	22.4	21.5	5.1	170
1935-36 ..	0.2	1.2	4.0	6.9	11.1	17.8	35.6	15.7	7.5	173
Unweighted Average ..	0.1	1.4	3.3	6.1	7.5	12.1	25.8	31.2	12.5	—

The index figures in the final column are most valuable as showing the great increase in production, especially since the 1932-33 season. It would appear that much of the change is due to the stimulus of the duties imposed on horticultural produce. As the original area under specialist intensive production is rather limited, it seems fairly obvious that the expansion has come from the more extensive cultivation on general farms. This fact appears to be corroborated by the June 4 statistics (see Table I).

The original duty operating from December 1931 on foreign cauliflower and broccoli was 3s. per cwt., or roughly $\frac{3}{4}$ d. per head. Since 1934 the duty from March 1 to June 30 is increased to 4s. per cwt., under the Import Duties Act, 1932. In the year following the application of these duties, the imports from France, the Netherlands and Italy alone were reduced from over 800,000 cwt. in 1931 to about 270,000 cwt., France and Italy suffering the greatest reduction. In 1932 about 14,000 cwt. each were imported from Belgium and the Channel Islands.

Since 1934 the trade returns have classified cauliflowers and

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broccoli as a separate return. In 1935 these imports amounted to 144,694 cwt., a reduction of over 9,000 cwt. on the previous year, and the declared value was £98,916. Imports from France and Belgium were both much heavier than in 1934, representing 82 and 44 per cent. of the total in each of the years 1935 and 1934. These increases were, however, offset by a considerable drop in imports from the other supplying countries, as the following table shows.* Empire supplies in 1935 were only 3 per cent. of the total importation, compared with 24 per cent. in 1934.

TABLE VII
MONTHLY IMPORTS OF CAULIFLOWERS AND BROCCOLI INTO
THE UNITED KINGDOM IN 1934 AND 1935*

Month	Channel Islands	France	Netherlands	Belgium	Italy	Other Countries	Total
1934	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
January ..	97	48	—	—	1,690	14	1,849
February ..	77	56	—	478	7,375	112	8,008
March ..	2,026	24,893	161	481	9,166	431	37,158
April ..	33,581	26,278	88	—	345	2	60,294
May ..	760	21	985	727	—	3	2,496
June ..	—	4	23,061	12,844	—	—	35,909
July ..	—	—	2,546	238	—	—	2,784
August ..	—	1	51	—	—	—	52
September	—	2	206	—	—	2	210
October ..	1	9	11	—	—	4	25
November	33	1,039	6	166	2,712	—	3,956
December	173	330	—	—	647	3	1,153
Total ..	36,748	52,681	27,115	14,934	21,935	571	153,984
1935							
January ..	160	24,493	—	—	487	6	25,146
February ..	678	37,557	—	—	420	20	28,675
March ..	1,689	9,886	—	—	1,077	6	12,658
April ..	838	8,725	103	15	336	1	10,018
May ..	4	5	1,824	1,586	66	—	3,485
June ..	—	90	15,935	28,776	—	—	44,801
July ..	—	—	1,256	2,495	—	—	3,751
August ..	—	—	142	—	—	—	142
September	3	—	119	—	—	—	122
October ..	69	16	66	—	—	1	152
November	30	1,161	22	—	—	—	1,213
December	121	3,330	1,035	—	—	45	4,531
Total ..	3,592	85,263	20,502	32,872	2,386	79	144,694

* Imperial Economic Committee, "Fruit Intelligence Notes," March 1936, p. 13

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It is of some importance to consider the seasonality of production—with due allowance being made for climatic features—as indicated in Table VI in relation to Table VII which shows the effect of import duties on French imports, which have shifted from March and April to January and February. Seasonality is often much more important than total supplies. Before 1931, the railway data placed emphasis on Cornish deliveries in March and April, but by 1934 there was a tendency for Cornwall to go for December, January and February deliveries. Owing mainly to the Colorado Beetle Regulations, France had shifted to the earlier production of January and February, so that if this is to be a fairly permanent feature, it is now interesting to speculate on what will be the Cornish procedure and choice of variety to meet a time when competing supplies will be at a lower level.

From this evidence it can be concluded that the early effect of the duties was to cause a very sharp reduction in the importation of broccoli and cauliflower, but in 1935 a portion of the reduction had been retrieved by France and Italy. It is, however, worth mentioning that since the reduction of imports, the West Cornwall production alone has greatly exceeded the total imports from overseas.

A NEGLECTED ASPECT OF PIG-KEEPING: MANURE PRODUCTION

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Some time ago information was sought regarding the rate of production of manure by feeding pigs. Wild guesses were hazarded, but none could be supported by any concrete evidence. A few instances will suffice to indicate how accurate information might be useful.

A smallholder farming, say, a 30-acre all-grass dairy farm, wishes to occupy his hours more fully and to increase his income by keeping more pigs. He has the cash and a good market for pork and bacon pigs. To what extent can he profitably expand in pig production? This is one of the major problems. Putting aside such considerations, at the moment, as the limits set by the amount of capital and labour available, it is obvious that for maximum profit the manure produced must be put to a useful purpose. There must be an adequate amount of land on which it can be applied without harming the herbage. The difficulty resolves itself into discovering how much manure can be expected from a certain number of pigs.

As part of an investigation carried out at the Midland Agricultural College from October, 1936, to April, 1937, the manure produced from several groups of pigs was weighed daily. These pigs were kept in modern Danish-type houses and provided with either chopped straw or shavings as bedding material, at the rate of $\frac{1}{2}$ - $\frac{1}{2}$ lb. per pig per day. All pigs were being fed for selling as baconers, and the maximum amount of food they were given was 7 lb. per head daily. The manure contained 70-78 per cent. of moisture.

The Table shows the weight of manure that can be collected per pig, kept under these conditions, per day at ages from 8 to 36 weeks.

From this Table it is easy to calculate the amount of muck produced by pigs during any portion of their lifetime from weaning to slaughter. For example, it has been calculated that one pig from the age of 8 weeks to 36 weeks will produce approximately $10\frac{3}{4}$ cwt. of "collectable" muck. On average, then, 1 pig produces $10\frac{3}{4}$ cwt. of manure in 28 weeks, i.e., approx. 1 ton in one year.

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Age of pig, weeks	Weight of manure per pig per day, lb.	Age of pig, weeks	Weight of manure per pig per day, lb.
8-10	3.0	22-24	5.8
10-12	3.2	24-26	6.5
12-14	3.5	26-28	7.2
14-16	3.8	28-30	8.0
16-18	4.2	30-32	9.0
18-20	4.8	32-34	10.1
20-22	5.3	34-36	11.5

Thus each head of stock maintained throughout the year on a farm where weaners are fed to bacon weight by the time they are 36 weeks old will produce 1 ton of manure.

Again, a feeder buying strong stores at 18 weeks old and then fattening them off by the age of 30 weeks, can count on one ton of pig manure being produced per head of (pig) stock maintained.

Between the ages of 8 and 30 weeks, one pig produces under the conditions defined above about 7 cwt. of "collectable" muck. Now, on the College Farm, each of the 30-40 breeding sows wean approximately 18 pigs per year, most of which are fattened off as baconers by the age of 30 weeks. Therefore the annual production of the progeny of one sow, say 18 pigs, would be $18 \times 7 = 126$ cwt. of "collectable" manure. If pork production be the object then pigs are finished at, say, 22 weeks old, and from the Table it will be found that each pig will produce (from 8 to 22 weeks old) approximately $3\frac{1}{2}$ cwt. of "collectable" muck. Thus the year's progeny of one sow finished as pork at this age will produce $18 \times 3\frac{1}{2} = 63$ cwt. of "collectable" muck.

Two further illustrations will serve to show how this information can be of use in ordinary farming practice.

Let us consider a typical mixed farm, part under plough and part pasture, where the usual practice is to apply some of the farmyard manure, at say 8-10 tons to the acre, to frequently-mown meadows, the greater portion being given to the arable land in preparation for root, silage and forage crops. A dressing of 10-25 tons of muck to the acre is ample for these crops and on most soils the application of greater amounts than, say, 30 tons per acre would probably result in considerable loss of plant nutrients. It is a wise policy, where much dung is available, to increase the acreage devoted to green crops

A NEGLECTED ASPECT OF PIG-KEEPING

and thus raise the level of fertility of the soil, so that the same bulk of cereals may be produced from the somewhat reduced area of land devoted to them. The taking of an extra root crop in the rotation is advocated because the land can be kept clean easily, the stock have a healthy, clean and abundant supply of succulent food in winter, and mechanical and chemical fertility of the soil is raised through constant cultivation and the application of natural and artificial manures to the roots.

Where large quantities of muck are produced the farmer is advised to consider a modification of his four-course rotation—wheat, roots, spring cereals and temporary ley, to the following: wheat, roots (including such cash crops as sugar beet and broccoli), oats (part barley, perhaps), ley for winter grazing and a hay crop, roots (including potatoes). A silage mixture might well be grown on a part of both root breaks. The proportion of arable land devoted to roots has been increased from $\frac{1}{4}$ to $\frac{2}{5}$. Thus on a farm with 40 acres arable worked on a four-course system there will be 10 acres of roots which will absorb, say, 150 tons of muck, whereas modification to the five-course system would involve the growing of 16 acres of roots and forage crops capable of absorbing $16 \times 15 = 240$ tons manure. It is important, then, to determine what number of pigs in addition to other stock constitute a suitable complement for the amount of arable land on the holding.

One other example may be cited—a corn-growing farm. Here, a major problem is the conversion of straw into manure and the maintenance of soil fertility in spite of exhausting cropping. The bullock-fattening yards have in many districts fallen into disuse, but there is no doubt that pigs can very successfully convert straw into muck. How many pigs should be kept in order to produce the required quota of farmyard manure?

Of course, considerations other than the amount of muck produced will be important in deciding what number of pigs can be most economically maintained.

A SIMPLIFIED METHOD OF CALCULATING BALANCED MIXTURES FOR MILK PRODUCTION

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The principle of rationing dairy cows in accordance with milk yield is now commonly practised in this country, since farmers adopting it have found that they can effect considerable economies in feeding costs by so doing. The methods of correlating food requirements with milk yield are so clearly outlined in the Ministry's Bulletin No. 42 that there is no need to give them in any detail here.

The main principle in these methods consists in working out a *maintenance ration* that suffices to supply the protein and energy required to maintain the cow in health. In addition to this maintenance ration, a *milk production ration* is calculated to supply the protein and energy required per gallon of milk produced. The ration for maintenance plus 1 gal. of milk is chiefly composed of home-grown foods, and once fixed will remain unaltered for a considerable length of time. For this reason, it is usual, and not unreasonable, to call in the services of the Agricultural Organizer to advise on its construction. The ration for milk production above 1 gal., on the other hand, may be mainly made up from purchased feeding stuffs, and in order that the farmer may take advantage of market changes in the price of feeding stuffs, he will constantly wish to change its composition. Unfortunately, the present methods of working out balanced rations for this purpose involve a fair amount of arithmetical calculation, and can only be obtained by trial and error. The Agricultural Organizer is too busy to be able to calculate such rations for every farmer in his county, and the farmer himself is also too much occupied with the demands of his business to attempt to master the present methods of calculating such rations. The writer has therefore made an attempt to simplify the calculation of such rations in the hope that he could evolve a method that the average farmer could use with reasonable ease.

CALCULATING BALANCED MIXTURES

Books and bulletins dealing with the scientific computation of rations contain tables of composition of feeding stuffs, and include data as to the amounts of protein equivalent and starch equivalent present in a pound of each feeding stuff quoted, and of protein equivalent and starch equivalent needed for every gallon of milk. From these figures the reader is expected to work out for himself balanced mixtures suitable for milk production, and also to estimate the amount of the mixture required for the production of each gallon of milk. In view of the difficulty experienced by the average reader in doing this, it is usual for the authors of such compilations to give a series of mixtures that are suitably balanced for milk production. Although this helps the reader to a certain extent, it prevents him from obtaining full value from the tables, and makes the system somewhat inelastic. In connexion with poultry production, the author of this article has evolved a somewhat simpler method of calculating rations for egg production, and it was decided that this method could also be applied to rations for milk production.

The method consists in constructing a table of composition of feeding stuffs commonly used for milk production, but, instead of giving the amounts of protein equivalent and starch equivalent present per pound, the table gives the amounts of milk yielded by this protein equivalent or starch equivalent. We thus get two columns of figures, in one of which is given the number of gallons of milk that the protein equivalent of one pound of the feeding stuff will yield in milk protein, and in the other is given the number of gallons of milk that the starch equivalent of one pound of the feeding stuff will yield in milk starch equivalent. The former figure is obtained by dividing the protein equivalent present in one pound of the feeding stuff by 0.6, which is the protein equivalent required to produce the protein in 1 gal. of milk; similarly, the starch equivalent in 1 lb. of the feeding stuff is divided by 2.5 which is the starch equivalent required to supply the energy in 1 gal. of milk. The following table of composition of feeding stuffs has been obtained in this manner. This method of presentation has two advantages: (1) it indicates at once to what extent the feeding stuff is balanced in itself, since if the figures given in the two columns are the same, such feeding stuffs will be perfectly balanced for milk production; (2) it also, as we shall see later, renders subsequent calculations much more simple.

CALCULATING BALANCED MIXTURES

TABLE OF COMPOSITION OF FEEDING STUFFS, GIVING THE AMOUNTS OF MILK, IN GALLONS, PROVIDED FOR IN THE FORM OF STARCH EQUIVALENT AND PROTEIN EQUIVALENT, BY EACH POUND OF FEEDING STUFF.

<i>Feeding Stuff</i>	<i>A</i> <i>Gallons Milk, as</i> <i>Protein Equivalent</i>	<i>B</i> <i>Gallons Milk, as</i> <i>Starch Equivalent</i>
Barley	0.10	0.28
Beans	0.33	0.26
Brewers' grains (dried)	0.22	0.19
Brewers' grains (wet)	0.08	0.07
Coconut cake	0.27	0.32
Cotton cake, decorticated	0.57	0.32
Cotton cake, undec. (Bombay)	0.25	0.16
Cotton cake, undec. (Egypt)	0.28	0.17
Dairy cakes	0.25-0.30	0.26-0.28
Distillers' grains	0.32	0.23
Fish meal	0.80	0.21
Ground-nut cake, dec.	0.68	0.29
Ground-nut cake, undec.	0.45	0.23
Linseed (flax seed)	0.32	0.48
Linseed cake	0.42	0.30
Maize	0.12	0.31
Maize, flaked	0.15	0.34
Maize germ meal	0.15	0.31
Maize gluten feed	0.32	0.30
Malt culms	0.27	0.17
Oats	0.13	0.24
Palm-kernel cake	0.28	0.30
Palm-kernel meal (extr)	0.28	0.28
Peas	0.30	0.28
Locust beans	0.07	0.28
Rice meal	0.12	0.29
Sesame cake	0.65	0.29
Soya-bean cake	0.60	0.28
Soya-bean meal (extr.)	0.63	0.26
Sugar-beet pulp (dry)	0.08	0.26
Treacle	0.05	0.20
Wheat	0.17	0.29
Wheat bran	0.17	0.17
Wheat midds. (coarse)	0.18	0.23
Wheat midds. (fine)	0.20	0.28
Yeast (dried)	0.68	0.27

It will be noted from the above table that bran, mixed dairy cakes, palm-kernel meal and maize gluten feed are well balanced foods for milk production, whereas the cereals and food of animal origin are not well balanced.

The following notes indicate the method of calculating a balanced mixture for milk production, and of estimating the number of pounds of the mixture to be fed per gallon of milk.

Case 1.—To Obtain a Balanced Mixture from Two Foods.

Foods that are badly balanced for milk production will obviously contain either too much protein equivalent or too much starch equivalent. It will be obvious that we cannot get a balanced mixture from two foods

CALCULATING BALANCED MIXTURES

that are both either high in protein equivalent or starch equivalent. We must therefore select two foods, one of which is high in protein equivalent, and another that is high in starch equivalent.

Example.—To balance bean meal and crushed oats. A little thought will suffice to show that in a balanced mixture the number of gallons of milk, as protein equivalent, will exactly balance the number of gallons of milk, as starch equivalent.

We are required to find how much bean meal we need to add to one pound of crushed oats to get this desired result. Let x represent the amount of bean meal required.

Now Protein Equivalent gal. = Starch Equivalent gal. Therefore, from table of composition given above

$$1 \times 0.13 + x \times 0.33 = 1 \times 0.24 + x \times 0.26$$

that is $(0.33 - 0.26)x = 0.24 - 0.13$

Therefore $0.07x = 0.11$
whence $x = 1.6$

That is to say, the balanced mixture is 1 lb. of oats and 1.6 lb. of bean meal, or 10 lb. of oats to 16 lb. of bean meal.

To find the quantity of this mixture required per gallon of milk produced is simple: it is done by taking the figures in either column A or column B of the table of composition and multiplying by the pounds of food of each ingredient used in the mixture. This gives the number of gallons of milk.

Thus 26 lb. of the mixture contains 10 lb of oats and 16 lb. of bean meal.

This will yield $10 \times 0.13 + 16 \times 0.33$ gallons of milk

$$= 1.3 + 5.28$$

$$= 6.58 \text{ gal.}$$

whence it follows that 4 lb. of the mixture should be fed per gallon of milk.

Case 2.—To Obtain a Balanced Mixture using more than Two Foods.

When more than two foods are used, all the foods except one are mixed in any desired proportion, and the protein and starch equivalent figures per pound of the mixture are worked out from the composition figures of the separate ingredients. This is then equated with the remaining food as given in Case 1.

Example.—To obtain a balanced mixture using bran, coarse midds. flaked maize, and decorticated ground-nut cake. It is decided to use 2 parts bran, 2 parts midds., and 1 part of flaked maize.

From the table of composition :—

	gal.	gal.
2 parts bran yield $2 \times 0.17 = 0.34$ P.E. and $2 \times 0.17 = 0.34$ S.E.		
2 parts midds. yield $2 \times 0.18 = 0.36$ P.E. and $2 \times 0.23 = 0.46$ S.E.		
1 part flaked maize		
yields $1 \times 0.15 = 0.15$ P.E. and $1 \times 0.34 = 0.34$ S.E.		

Therefore 5 lb. of the mixture

yield 0.85 gal. P.E. and 1.14 gal. S.E.

Therefore 1 lb. yields 0.17 gal. P.E. and 0.23 gal. S.E.

CALCULATING BALANCED MIXTURES

Equating one pound of the mixture against x lb. of decorticated ground-nut cake we get :—

$$\begin{aligned} 1 \times 0.17 + x \times 0.68 &= 1 \times 0.23 + x \times 0.29 \\ \text{whence } (0.68 - 0.29)x &= 0.23 - 0.17 \\ \text{whence } 0.39x &= 0.06 \\ \text{i.e. } x &= 0.15 \end{aligned}$$

Therefore the mixture will be 15 lbs. of ground-nut cake to every 100 lbs. of the cereal mixture.

To find the number of lb. of mixture required per gallon of milk produced :—

$$\begin{aligned} 115 \text{ lbs. of the mixture will give } 100 \times 0.17 + 15 \times 0.68 \text{ gallons} \\ = 17 + 10.2 \\ = 27.2 \text{ gallons.} \end{aligned}$$

The number of lb. of food per gallon will, therefore, be 115 divided by $27.2 = 4\frac{1}{4}$ lb. approx.

SPRAYING FOR PLUM SAWFLY:

WITH NOTES ON RED SPIDER AND THRIPS

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The Plum Sawfly (*Hoplocampa flava* L.) is still a serious pest of plums in East Anglia, and in those seasons when the "set" of plums is poor it causes big losses, especially to Czar plums, to damsons, and to a less extent to Victoria plums. Previous experiments (1, 2)* in this country have shown that the time of spraying is important, and that the best control has been obtained by spraying with Derris, together with a mineral oil emulsion or with a spreader.

In 1936 Leib³ carried out a series of spraying experiments in the Rhineland against the continental Plum Sawfly (*Hoplocampa minuta* Christ.). In these experiments he found that spraying with 3 per cent. quassia (alone or with 0.5 per cent. soap) gave excellent results, considerably better than by spraying with 0.4 per cent. Derris.

Other German workers Jancke and Maercks⁴ also carried out spraying experiments against the same pest in the Rhine Palatinate and they found that an extract of quassia chips (3 lb. to 10 gal.), with or without the addition of 0.25 per cent. of soft soap, gave good results. They also give their experience of the keeping qualities of the quassia spray: "an extract of quassia was kept for a fortnight until it began to have a putrid odour, and to throw down a flocculent precipitate. It was tested daily against *Aphis pomi* De Geer, and no decrease in efficiency was observed, so that it would seem that a quassia spray ready for use could be kept for some days if the weather should prevent its immediate application."

Since carrying out the experiments described in this paper our attention has been drawn to experiments in Germany by Thiem⁵ on the control of both *H. flava* and *H. minuta*. The following account is extracted from the *Review of Applied Entomology* (Vol. 25, Ser. A, Part 8, p. 465, Aug., 1937).

Tests in various parts of the country have proved the efficiency of quassia extract with or without soap against these sawflies. To prepare the spray with soap: 3 lb. quassia chips are soaked for several hours in 3 gal. water and then boiled for an hour. The liquid is strained off and a solution of $\frac{1}{4}$ lb. soft soap in 1 gal. water is added. The mixture is

* For references see p. 865.

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then diluted to make 10 gal. In each year the first application was made when the larvae began to hatch, which they usually do when the petals are falling. Most of the withered calyces had fallen or the fruitlets had developed at the time of the last application. The best time with early or medium blossoming plums is when most of the petals have fallen. Quassia acts on the eggs and also on the young larvae that come in contact with a sprayed surface or feed on sprayed fruitlets. The larvicidal action did not occur with Codling Moth (*Cydia pomonella* L.). The quassia spray destroyed leaf aphides, but was quite harmless to bees.

Experiments were carried out in 1937 to test the value of quassia as compared with Derris.

Experiment I. This experiment was carried out near Cambridge in a large orchard belonging to Messrs. Chivers & Sons, Ltd. The trees sprayed were very large damson trees (over 40 years old) and 10-year-old Czar plum trees, planted in alternate rows. On April 30, petals had begun to fall on the Czars and were falling fast on the damsons. On this date only one sawfly was found after twenty minutes beating. The spraying was carried out on May 10, when the "cots" (= receptacles) of the young plums on both the Czars and damsons were beginning to split. At this date no sawfly larvae were found. The following mixtures were used:—

(1) Derris	..	..	..	..	13 oz.	= 0.2%
Sulphonated Lorol	..	..	..	..	3 oz.	
Water	..	..	..	..	40 gal.	
(2) Derris	..	..	..	..	13 oz.	= 0.2%
*Mineral Oil Emulsion (proprietary)	..	..	..	..	3½ pints	= 1.0%
Water	..	..	..	..	40 gal.	
(3) Quassia	..	..	..	..	12 lb.	= 3%
Soft soap	..	..	..	..	1 lb.	= 0.25%
Water	..	..	..	..	40 gal.	

* This Mineral Oil Emulsion (made from summer oil) contained 83 per cent. oil by volume (85 per cent. by weight) and had a guaranteed unsulphonated residue figure of 99.9 per cent.

The making of the quassia spray was started on May 7; the soft soap was dissolved in *well* water and then the quassia chips were added. On the morning of the spraying the quassia-soap solution was poured through a strainer to remove the chips and then diluted to the required strength. The quassia chips were thus soaked for three days. In making wash No. 2 the mineral oil emulsion was first added to the water, and the Derris powder was then mixed with a small quantity of water and added to the emulsion in the tub. Blocks of trees in seven adjacent rows were sprayed on May 10.

SPRAYING FOR PLUM SAWFLY

A power sprayer was used, giving a pressure of 250 lb. with 6 lances. Twenty Czar trees and 32 damson trees were sprayed with mixture (1). Fourteen Czar trees and 6 damson trees were sprayed with nearly 80 gal. of mixture (2). Eighteen Czar trees and 5 damson trees were sprayed with nearly 80 gal. of mixture (3). Twelve Czar trees and 5 damson trees were left as controls.

On June 2 a count was made of sound and sawfly-infested plums (200 plums were counted at random on each tree), the results being recorded in Table I.

TABLE I (CZAR PLUMS)

<i>Treatment</i>	<i>Date of Spraying</i>	<i>Total Plums Counted</i>	<i>Percentage Damaged by Sawfly</i>
Control	—	2 200	33·0
Derris 13 oz.	May 10	2,000	6·6
Sulphonated Lorol .. 3 oz.			
Water 40 gal.			
Derris 13 oz.	"	2,800	3·1
Proprietary Mineral Oil Emulsion .. 3½ pints			
Water 40 gal.			
Quassia 12 lb.	"	3,600	0·3
Soft soap 1 lb.			
Water 40 gal.			

On August 6 and 11 the plums were picked and weighed; the average weight per tree is given in Table II.

TABLE II (CZAR PLUMS)

<i>Treatment</i>	<i>No. of Trees</i>	<i>Weight of Plums in lb.</i>	<i>Average Weight per Tree in lb.</i>
Control	12	103	8·6
Derris 13 oz.	20	340	17·0
Sulphonated Lorol .. 3 oz.			
Water 40 gal.			
Derris 13 oz.	14	298	21·4
Proprietary Mineral Oil Emulsion .. 3½ pints			
Water 40 gal.			
Quassia 12 lb.	17	320	18·8
Soft soap 1 lb.			
Water 40 gal.			

On June 2, a count was made of the sound and sawfly-infested damsons, 2 or 3 lots of 100 damsons being taken at random on each tree; the results are recorded in Table III.

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TABLE III (DAMSONS)

<i>Treatment</i>	<i>Date of Spraying</i>	<i>Total Damsons Counted</i>	<i>Percentage Damaged by Sawfly</i>
Control	—	1,400	19.7
Derris 13 oz.	} May 10	1,500	5.7
Sulphonated Lorol .. 3 oz.			
Water 40 gal.			
Derris 13 oz.	}	1,500	1.4
Proprietary Mineral Oil Emulsion 3½ pints			
Water 40 gal.			
Quassia 12 lb.	} ..	1,500	0.1
Soft soap 1 lb.			
Water 40 gal.			

The crop on these trees was a light one, the control trees averaging about half a hundredweight per tree. Owing to the variation in the size of the trees and the loss of large branches on some, a strict comparison of the crop from the various plots was not possible. The sprayed trees gave a higher yield and this was particularly noticeable on the plots sprayed with quassia or with mineral oil and Derris.

Experiment 2. This experiment was carried out at Over, Cambs., in an orchard belonging to Mr. R. Cole. The trees sprayed were Czars, nearly forty years old, and closely planted so that the tops of the trees interlaced except where a tree had been removed. The fruit was mainly on the tops of the trees. These trees were in full bloom on April 28, and on April 30 the petals had begun to fall. On April 30 two sawflies were found after half-an-hour's beating.

The spraying was carried out on May 14 when the "cots" of the young plums were beginning to split. At this date no sawfly larvae were found. The following mixtures were used:

- | | |
|-----------------------------------|----------|
| (1) Derris | 13 oz. |
| Sulphonated Lorol .. | 3 oz. |
| Water | 40 gal. |
| (2) Derris | 13 oz. |
| *Proprietary Mineral Oil Emulsion | 3½ pints |
| Water | 40 gal. |
| (3) Quassia | 12 lb. |
| Soft soap | 1 lb. |
| Water | 40 gal. |

* This mineral oil emulsion (made from summer oil) contained 83 per cent. oil by volume (85 per cent. by weight) and had a guaranteed unsulphonated residue figure of 92 per cent.

In order to have the quassia wash at hand when required the making of this was started on May 7. The soft soap

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was dissolved in *well* water and then the quassia chips were added. These were removed by means of a strainer on the morning of the spraying. As the spraying did not take place until May 14, the quassia chips were soaking for nearly 7 days. Eight rows of trees were used in this experiment and each plot consisted of a block of 25 or more trees. There were eight plots in all, so that each treatment was duplicated. A power sprayer was used giving a pressure of 250 lb. with two lances. The spraying was done by Mr. Cole's usual spraying staff.

On June 2 a count was made of sound and sawfly-infested plums, 100 plums per tree being counted at random; the results are recorded in Table IV.

TABLE IV.—CZAR PLUMS (SPRAYED MAY 14)

Treatment					Plot	Total Plums Counted	Percentage Damaged by Sawfly
Control	..	..	..	—	{ 4	2,500	15.2
					8	1,200	16.1
Derris	..	..	..	13 oz.	{ 2	2,400	5.9
Sulphonated Lorol	..	..	..	3 oz.		2,300	5.2
Water	..	..	..	40 gal.			
Derris	..	..	..	13 oz.			
Proprietary Emulsion	Mineral	Oil	..	3½ pints	1	2,900	3.3
Water			..	40 gal.	5	2,600	2.3
Quassia			..	12 lb.			
Soft soap			..	1 lb.	3	2,800	1.4
Water			..	40 gal.	7	2,200	1.5

The crop on these trees was a very light one, the control trees averaging about 3 lb. of plums, whereas the sprayed trees averaged over 10 lb. per tree. Owing to the variation in the size of trees and the loss of large branches on some, a strict comparison of the crops from the various plots was not possible.

These experiments show that quassia extract, with a weak soft soap solution and sprayed at a strength of 3 per cent. when the "cots" of Czars and damsons are beginning to split, gives a very good control of the Plum Sawfly. Mineral oil emulsion and Derris sprayed at the same time gave a good control, and although not as good as the quassia wash was better than Derris and Sulphonated Lorol. Mineral oil and Derris was the only one of the three washes to bring about an appreciable reduction in the numbers of the Fruit Tree Red Spider and of the Thrips (*Taeniothrips inconsequens*) and

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gave a heavier crop than the other two sprays where these pests were present.

How the Sprays affected the Red Spider. The Fruit Tree Red Spider (*Oligonychus ulmi* Koch.) is one of the worst pests of Czar plums and is particularly severe on damsons in Cambridgeshire; many damson orchards are sprayed every year with lime-sulphur (1 in 60) plus a spreader, about ten days to a fortnight after petal fall. The trees in the above experiments were not sprayed for Red Spider this year.

In spite of the wet season the Red Spider on plums and apples increased rapidly in numbers and caused considerable browning of the leaves in a large number of plantations. As the trees in the above experiments varied in the amount of Red Spider attack, an estimate of the infestation of each tree was made on July 9 and 12. Where no obvious leaf damage was seen, 0 was recorded; where the leaf damage was very severe 100 was recorded. Intermediate marks were given for less severe attacks. By this method the following figures were obtained:—

TABLE V.—ESTIMATE OF RED SPIDER ATTACK (AVERAGE PER TREE)

					Czars (Over)	Czars' (Histon)	Damsons
Control	..	..	..	{ Plot 4	28.3	65.0	72.0
				„ 8	25.5		
Derris + Sulphonated Lorol	..			{ „ 2	21.4	54.1	44.0
				„ 6	20.0		
Derris + Mineral Oil Emulsion	..			{ 1	6.8	13.5	14.1
				5	9.6		
Quassia + Soft soap	..	..		{ 3	19.0	50.5	54.0
				7	27.4		

These figures show that quassia and soft soap was of little value in reducing attacks of Red Spider and the same applies to Derris + Sulphonated Lorol. The Derris and mineral oil emulsion, on the other hand, gave a fairly good reduction of Red Spider, and at the time of making these counts this was noticeable in the greenness of trees in these plots. At the time of picking, however, some of the damson trees on the plot where mineral oil was used were little better than the neighbouring controls, whereas others were easily distinguishable by their greener colour.

How the Sprays affected the Thrips Injury to the Plums. In Experiment I, the damage caused by Thrips (*Taeniothrips*

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inconsequens Uzel.) was noticeable but not very bad. This damage has been described in a previous paper^a. A count of the marked Czar plums showed that those from the trees sprayed with mineral oil and Derris were much cleaner than those on the unsprayed trees, whereas on the other two plots the markings were very similar in extent to those on the controls.

In Experiment II the damage caused by Thrips was severe. On the control plots about 95 per cent. of the plums were Thrips-marked, and the trees sprayed with Derris + Sulphonated Lorol and with quassia + soft soap were little better. On the plots sprayed with mineral oil and Derris, only about 50 per cent. of the plums were Thrips-marked and even on these the markings were not so severe as on the other plots.

Suggested Control Measures.

1. For the Control of Plum Sawfly only—

Quassia	..	..	..	12 lb
Soft soap	..	.	..	1 lb.
Water		..	..	40 gal.

The quassia chips should be soaked in the soap solution for at least 24 hours. No experiments have been carried out with concentrated extracts of quassia, which if they give the same results are less troublesome to use than the quassia chips.

2. For the Control of Plum Sawfly when Fruit Tree Red Spider or Plum Thrips are troublesome—

Mineral Oil Emulsion	.			3½ pints
Derris	..	..	..	12 oz.
Water	..	.	..	40 gal

This is likely to give better yields and cleaner plums or damsons than the soft soap and quassia where Red Spider or Thrips are troublesome. *The spraying should always be done when the "cots" (=receptacles) are beginning to split.*

Mixtures containing mineral oil and quassia or lime-sulphur and quassia may be worth a trial, although no experiments have as yet been carried out with these washes.

Summary. In the above experiments one spraying with 3 per cent. quassia and soft soap when the "cots" of Czar plums and damsons were beginning to split gave a very good control of the Plum Sawfly (*Hoplocampa flava* L.). Mineral oil emulsion and Derris also gave a good control, but Derris and Sulphonated Lorol was not quite so good.

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Mineral oil and Derris was the only one of these washes to check the Fruit Tree Red Spider (*Oligonychus ulmi* Koch) and also the Thrips (*Taeniothrips inconsequens* Uzel.).

The authors are very much indebted to Mr. J. H. Stapley for his assistance in recording, to Mr. K. V. Cramp, Horticultural Organizer for Cambridgeshire, for his co-operation, and also to the growers named for the facilities afforded in carrying out these experiments.

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NOTE ON THE USE OF CHLORATE WEED-KILLERS

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During the last ten years there has been a decided growth in the use of weed-killers in which the active principle is a chlorate—usually sodium chlorate. This compound appears to possess all the requirements of a good weed-killer. It is easily soluble in water, it is non-poisonous to animals, and it is toxic to plants whether applied to the foliage or at the roots. Its only failing is that it is not specific for weeds, and, consequently, carelessness in its use is apt to lead to serious losses of cultivated plants. That this is happening on an increasing scale is the reason for the present note.

Ever since 1927, the Cheshunt Research Station has been consulted frequently about damage to plants in commercial nurseries, market gardens, and private gardens where the responsible agent has been chlorate. In the main the commonest plant affected has been the tomato, but many plants raised for bedding purposes and for decorative work have been submitted for examination. The first instance in the records here was that of severe injury to tomato plants. The plants affected were confined to certain areas in two particular houses on a nursery. Soon after planting, the lower leaves became desiccated and eventually dropped off, while the tops of the plants showed a mottle similar to mosaic. Later, lesions appeared on the stems. The affected areas had been replanted several times without success and the application of various fertilizers was of no avail. Neighbouring plants in other parts of the same houses made normal growth and bore fruit. In this particular instance the presence of chlorate in the soil was proved in concentrations between 0.02 and 0.03 per cent. sodium chlorate, but its origin is still a mystery.

Since that time many cases have been dealt with, and the source of the chlorates traced. In one instance injury to plants *twelve feet* away from a glasshouse wall was traced to an application of sodium chlorate to the nursery road outside the house, six weeks previously. Heavy rain had washed

USE OF CHLORATE WEED-KILLERS

the chlorate underneath the wall foundation into the house. In another instance the loss of some thousands of tomato seedlings was due to the fact that in moving the seed boxes from one part of the nursery to another, it had been necessary to stand them in a road for some little time. The road had been treated with chlorate and the bottoms of the boxes were sufficiently wet to take up the chlorate necessary to damage the seedlings.

Injury to rows of plants adjacent to walls outside which chlorate has been applied is quite common. Another way in which chlorate can be introduced is from standing-out ground. Here it is applied to keep down weeds and quite often the pots are carried into houses at some time or other. Enough chlorate can be carried on the pots in this way to have a serious effect on susceptible plants, such as tomatoes, when planted in the houses. Further, it is not easy completely to wash out the chlorate from ordinary earthenware pots, and although some plants show a low susceptibility to chlorates, when the pots are used for susceptible plants damage is almost certain. The effect of mild poisoning on a tomato leaf is shown in Fig. 1 and more severe injury in Fig. 2.

The first instance of damage to chrysanthemums was due to the fact that solid chlorate had been applied to the standing-out ground and the workmen responsible had omitted to wash it in. This explained the first case of chrysanthemum injury on this particular nursery, where chlorates had been used without harm for several years previously.

The first effect of chlorate on the chrysanthemum is to make the veins pale; then the leaf crinkles, distortion of the upper leaves occurs, and finally the whole leaves appear to shrink and turn a peculiar grey-green colour. The effect on the whole plant is to cause stunting of the tops while the lower leaves exhibit little or no abnormality (see Fig. 3).

General damage to crops in a kitchen garden was traced to contamination of the water supply. Application of chlorate to paths was followed by heavy rain. Some days later vegetables growing some distance away from the treated paths showed general mottling and distortion, which was attributed to a parasitic disease. The damage was, however, traced to the use of water from a pond into which the treated paths drained. In another instance considerable injury to plants in a conservatory is believed to have been due to the fact that a watering can used for watering weed-killer on to paths had been

USE OF CHLORATE WEED-KILLERS

dipped into the water reservoir normally reserved for use in the conservatory!

That there is variation in the susceptibility of plants to chlorates has been shown by pot experiments.

During sunny weather, tomatoes under glass will show ill-effects of concentrations in the soil of the order of one part of sodium chlorate in ten thousand parts of soil, within twenty-four hours. Dahlias and winter cherries are, if anything, more susceptible than tomatoes, and under similar conditions show serious scorching and desiccation within forty-eight hours, and plants are apparently dead at the end of five days. Garden nasturtiums and wallflowers are slightly less susceptible, but the damage is unmistakable at concentrations of the order of one-and-a-half to two parts per ten thousand. Cinerarias and asters show a somewhat higher resistance, but the symptoms are apt to be confused with those ordinarily associated with a virus. Veins darken and a mild mottle appears at first. Later, the mottle becomes more pronounced and distortion of the younger leaves occurs. Finally the browning of the veins is general and desiccation of the older leaves begins (Fig. 4).

The effect of low concentrations on young cucumber plants is not unlike that on asters, and is shown in Fig 5.

Lettuces show symptoms similar to those described for the aster, although at low concentrations of chlorate there is no browning of the veins, but broad beans show general distortion and paling of the foliage for considerably longer periods.

The antirrhinum shows comparatively high resistance, and when a concentration of the order of two parts per ten thousand is present in the soil, some growth continues, although the veins of all the leaves are very pale in colour.

Fig. 6 shows the effect of a concentration of slightly less than one part per ten thousand on a primula, as compared with a healthy plant of the same age. The same concentration causes injury to the sweet pea. Some stunting and distortion are accompanied by general vein clearing. Both these plants were included in a batch of various plants that suffered injury following the careless use of weed-killer.

Heaths show a resistance higher than other plants examined, and at the concentrations mentioned here plants appear to be unaffected.

In response to many inquiries we have examined at various times most of the artificial fertilizers used in glasshouse work,



FIG 1 —Signs of mild poisoning on tomato leaf



FIG 2 More severe injury to tomato plant

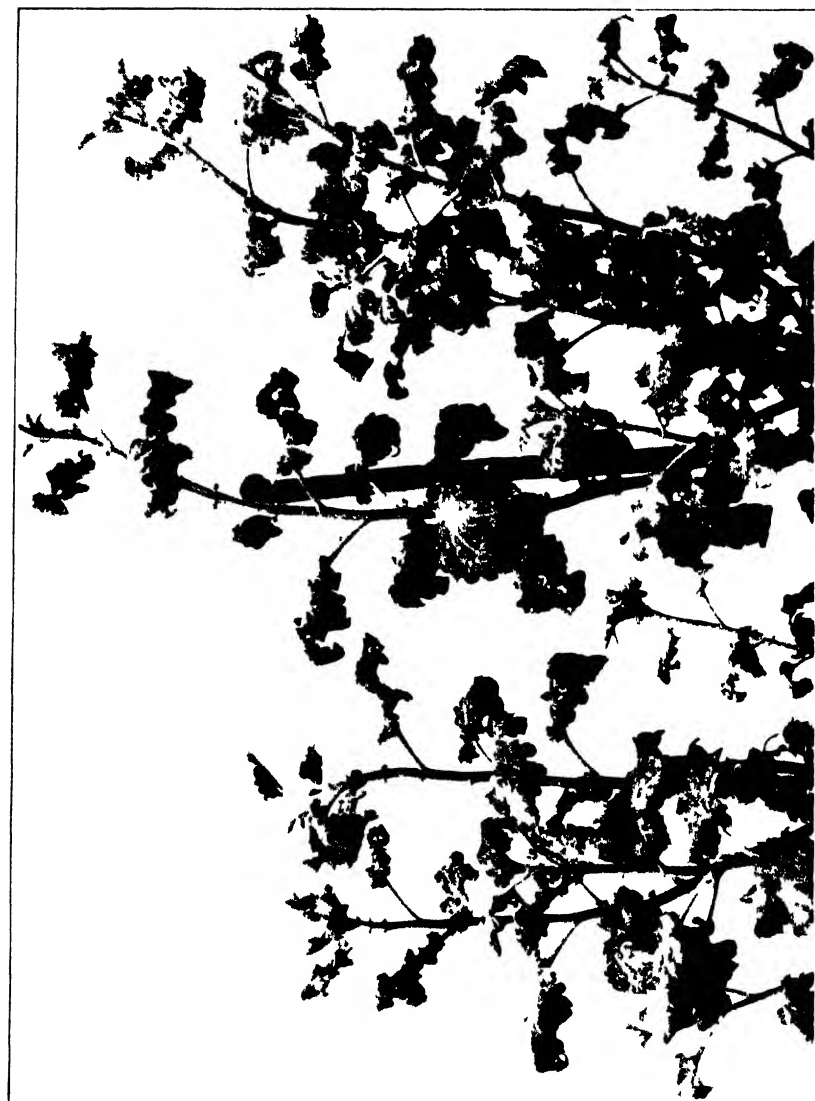


FIG. 3 — 1 ft. ct. of *poise min.* on *Ery-anthemum*. Note the stunting of the tops.



FIG 4.— Mottling and distortion of Aster plant due to poisoning

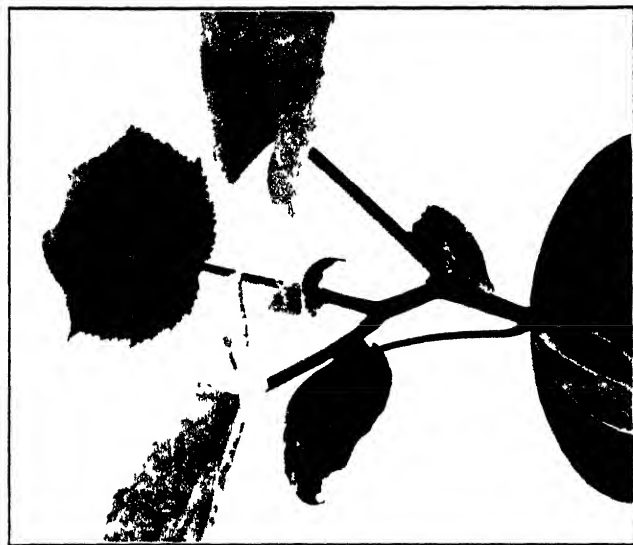


FIG 5 Effect of poisoning on Cucumber plant.



Fig. 6. Effect of poison on Prunella. The plant on the right is healthy.

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and never has a trace of chlorate been found in them. Nor have we found traces in "normal" uncontaminated water supplies.

Two questions arise. The first is whether anything can be done with soil that has been contaminated. Beyond washing there appears to be no treatment that assists matters. Addition of stable manure and the application of sulphate of ammonia have a transient beneficial effect, but symptoms generally recur, although possibly in a milder form. Where the chlorate concentration is very low, plants may recover after watering and subsequent feeding.

The second question is how long soil is likely to remain toxic in the open. This must depend on the type of soil and the water that it receives. Unless the rainfall is high it appears that a dressing of half an ounce to the square yard will be toxic to plants for some months.

In conclusion, it should be emphasized that care must be exercised in the use of this type of compound, and that where boxes or pots have become contaminated with chlorates they should be washed carefully before further use.

Grateful acknowledgement is made to Dr. G. C. Ainsworth for taking the photographs.

LIVE STOCK IMPROVEMENT:

REPORT FOR THE YEAR ENDED MARCH 31, 1937

PART II*

Milk Recording. Table XII shows the number of members of Milk Recording Societies, together with the number of herds and cows recorded, in each year since 1917-18, when all Societies were required to adopt a uniform year.

TABLE XII.—NUMBER OF MILK RECORDING SOCIETIES

<i>Year ended</i> <i>October 1</i>		<i>Societies</i>	<i>Members</i>	<i>Herds</i>	<i>Cows</i>
1917-18	27	639	708	19,793	
1918-19	38	1,191	1,332	37,880	
1919-20	46	2,075	2,312	61,323	
1920-21	52	3,328	3,664	97,903	
1921-22	55	3,949	4,362	117,023	
1922-23	55	4,365	4,767	127,151	
1923-24	52	4,764	5,209	138,089	
1924-25	50	5,081	5,516	148,905	
1925-26	49	5,174	5,656	154,322	
1926-27	51	5,166	5,650	156,847	
1927-28	50	4,862	5,320	149,971	
1928-29	50	4,616	5,065	144,812	
1929-30	49	4,501	4,934	140,266	
1930-31	49	4,412	4,836	137,866	
1931-32	49	4,267	4,682	135,912	
1932-33	49	4,187	4,598	135,902	
1933-34	49	4,211	4,622	141,325	
1934-35	49	4,264	4,696	148,426	
1935-36	49	4,355	4,792	156,268	

As in the last two years, membership of Milk Recording Societies showed an increase in 1935-36, and there is every indication that this increase will be maintained in the current year.

Average Yield of Recorded Cows. The excellent hay crop of 1935 was followed by a winter that was not too severe, and these factors, combined with the greater attention that is now being paid by milk producers to rationing, caused milk yields to be maintained at a very high level, with the result that a new record for the average yield of full-year

* The first part of the report appeared in the November, 1937, issue of this JOURNAL.

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cows was set up. The average of 741 gal. was 7 gal. in excess of the previous record obtained in 1934-35, and 28 gal. in excess of the average for the 5 years ending 1934-35.

The number and average yield of milk of all cows recorded, and of full-year cows, for each year since 1917-18 are shown in Table XIII.

TABLE XIII.—AVERAGE YIELD OF RECORDED COWS

Year Oct. 1 to Oct. 1	Particulars of all cows and heifers recorded			Particulars of cows recorded for full year			
	No. of cows and heifers	Total yield	Aver- age yield*	No. of cows	Percent- age of total cows and heifers	Total yield	Aver- age yield*
		Gal.	Gal.			Gal.	Gal.
1917-18	19,793	8,426,958	426	8,775	44	5,255,923	599
1918-19	37,880	16,204,941	450	17,989	47	10,543,516	579
1919-20	61,323	29,344,887	479	27,266	44	17,363,347	637
1920-21	97,903	48,512,380	495	48,248	49	30,892,620	640
1921-22	117,023	60,463,617	517	63,318	54	41,208,073	651
1922-23	127,151	67,904,224	534	68,349	54	46,956,565	687
1923-24	138,086	73,963,165	535	73,338	53	50,299,884	685
1924-25	148,905	76,419,498	513	77,132	51	51,695,291	670
1925-26	154,322	81,623,788	529	81,669	53	56,102,434	687
1926-27	156,847	82,161,809	524	81,749	52	55,677,261	681
1927-28	149,971	76,896,131	513	77,171	51	51,931,633	673
1928-29	144,812	75,948,485	524	74,171	51	51,207,594	690
1929-30	140,266	75,293,001	537	71,432	51	50,766,464	711
1930-31	137,866	75,357,035	547	71,480	52	51,386,105	719
1931-32	135,912	73,793,049	543	70,826	52	50,243,265	709
1932-33	135,902	73,422,655	540	73,328	54	51,300,933	700
1933-34	141,325	76,274,826	540	74,493	53	52,423,417	704
1934-35	148,426	82,661,157	557	76,178	51	55,921,162	734
1935-36	156,268	87,862,328	562	78,757	50	58,339,461	741

* Before 1924-25 the average yield was calculated at the equivalent of 10½ lb. to a gallon, and subsequently at 10½ lb.

Increased average yields for full-year cows were secured by 29 societies, the largest increase being 530 lb.—from 7,185 lb. (695 gal.) to 7,715 lb. (747 gal.) in Shropshire. The highest average yield ever obtained was returned by the Derby and District Society with 9,099 lb. (881 gal.), while Essex also returned the very high average of 8,534 lb. (826 gal.). Averages in excess of 8,000 lb. (774 gal.) were also obtained by Hereford, Hertford, Norfolk, Peak, Suffolk and Yorkshire. Twenty societies had average yields between 7,500 lb.

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(726 gal.) and 8,000 lb. (774 gal.), and twelve obtained yields between 7,000 lb. (677 gal.) and 7,500 lb. (726 gal.).

The number of individual herds with average yields, for full-year cows, of 8,000 lb. (774 gal.) or over was 1,576, or 36 per cent. of the total herds recorded for the full year, as compared with 1,504 in the previous year and only 1,193 in 1933-34. Herds with average yields of 10,000 lb. (968 gal.) or over numbered 353, against 304 in 1934-35, while 32 herds had average yields of over 13,000 lb. (1,258 gal.). In Table XIV are given a few examples of the increase effected in the average yields of herds as a result of recording, together with approximate estimates of the cash value of the increased yields. These examples indicate that much improved returns may be obtained in individual herds as a result of the greater attention to breeding, selection and feeding that normally follows the adoption of milk recording.

TABLE XIV

Herd	No. of years during which records have been taken	Average yield per cow in first year	Average yield per cow in last year	Increase in annual average yield per cow	No. of full-year cows in last year of period	Cash value of increase of last year over first year at 1s per gallon	
						Per cow	Per herd
A (Pedigree Jersey)	8	Gal. 583	Gal. 979	Gal. 396	26	£ s. 19 16	£ s. 514 16
B (Non-Pedigree Shorthorn)	6	619	873	254	37	12 14	469 18
C (Pedigree Friesian)	8	730	1,115	385	18	19 5	346 10
D (Pedigree Guernsey)	16	504	951	447	15	22 7	335 5
E (Pedigree Red Poll)	9	677	890	213	19	10 13	202 7

The standard yield prescribed for their breed or type was reached by 24,361 cows, as compared with 22,082 in 1934-35 (Table XV). The number of Shorthorns with yields of 9,000 lb. or over increased from 10,192 to 10,876 and Friesians that gave 10,000 lb. or over increased from 5,796 to 6,326. Yields exceeding 10,000 lb. (968 gal.) were given by 14,919 cows, an increase of 1,382 over the previous year, while 108

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gave over 20,000 lb. (1,935 gal.) against 79 in 1934-35. The highest yield recorded during the year was 27,854 lb. (2,696 gal.), given by a Friesian cow owned by a member of the Suffolk Society.

TABLE XV.—NUMBER OF COWS THAT GAVE THE STANDARD YIELD PRESCRIBED FOR THEIR BREED OR TYPE DURING THE YEAR ENDED OCTOBER 1, 1936, CLASSIFIED ACCORDING TO BREED AND YIELD.

Breed or Type	Standard yield	Yields (in lb)								Total number of cows giving the standard yield
		8,000 to 9,000	9,000 to 10,000	10,000 to 11,000	11,000 to 12,000	12,000 to 14,000	14,000 to 16,000	16,000 to 20,000	Over 20,000	
		lb.								
Ayrshire ..	9,000	—	670	353	228	147	27	10	3	1,438
Blue Albion ..	9,000	—	47	26	17	25	7	4	2	128
Devon ..	8,000	41	13	6	1	—	1	—	—	62
Friesian ..	10,000	—	—	1,996	1,471	1,693	699	373	94	6,326
Guernsey ..	8,000	1,116	668	327	142	110	28	8	—	2,399
Jersey ..	8,000	631	325	174	107	52	10	3	—	1,302
Lincoln Red ..	9,000	—	120	79	44	37	9	2	—	291
Shorthorn ..	9,000	—	471	302	164	127	29	15	1	1,109
Red Poll ..	9,000	—	5,030	2,927	1,487	1,112	225	87	8	10,876
South Devon ..	8,000	115	63	41	24	12	3	1	—	259
Welsh Black ..	8,000	26	19	6	5	3	1	—	—	60
Other Breeds ..	8,000	*58	29	10	8	6	—	—	—	111
TOTALS ..	—	*1,987	7,455	6,247	3,698	3,324	1,039	503	108	24,361

* Includes 11 Dexter cows with yields of 7,000 to 8,000 lb (Standard yield for Dexter is 7,000 lb.)

The total number of cows and heifers of certain breeds recorded during the year ended October 1, 1936, and the number and average yield of the cows recorded for the full year, together with the percentage of full-year cows are shown in Table XVI. The number of Shorthorns recorded increased by 3,047 as compared with 1934-35, while Ayrshires increased by 1,602 and Friesians by 1,243. Most of the breeds recorded in any considerable number showed an increase in the average yield for full-year cows. Shorthorns, which accounted for 55 per cent. of the total cows recorded, averaged 7,382 lb. against 7,318 lb. in 1934-35, while Friesians averaged 9,418 lb. and Ayrshires 7,681 lb., showing increases of 127 lb. and 167 lb. respectively on the year. Devons, South Devons, Red Polls and Welsh Blacks, however, had reduced average yields.

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TABLE XVI

Breed or type	Total number of cows and heifers recorded	Particulars of cows recorded for full year			
		Number	Percentage of total of cows and heifers	Total yield	Average yield
				lb.	lb.
Ayrshire ..	8,238	4,197	50.9	32,237,410	7,681
Blue Albion ..	478	285	59.6	2,395,005	8,404
Devon ..	676	413	61.0	2,462,898	5,963
Friesian ..	25,930	13,742	52.9	129,427,659	9,418
Guernsey ..	13,809	6,668	48.2	46,234,961	6,934
Jersey ..	8,579	4,238	49.3	28,271,874	6,671
Lincoln Red ..	2,233	1,145	51.2	8,238,914	7,196
Red Poll ..	6,974	3,963	56.8	29,776,856	7,514
Shorthorn ..	85,487	42,191	49.3	311,466,382	7,382
South Devon ..	1,960	920	46.9	6,092,761	6,623
Welsh Black ..	716	445	62.1	2,572,986	5,782

Issue of Certificates. A new record was established by the number of Certificates of Merit issued during the year. Certificates issued in respect of the three years ended October 1, 1936, numbered 733, as compared with 665 for the previous three-year period. In addition, 33 Certificates of Merit were issued during the year in respect of earlier periods. Certificates of Merit are awarded on application by the owner, and on payment of a fee of 5s. for each certificate, for cows that have given during a period of three consecutive Milk Recording Years the prescribed yield of milk for their breed or type and have been shown to be regular breeders. The number of members of Milk Recording Societies who obtained Certificates of Merit was 221, an increase of 15 over the previous year. Certificates issued in respect of the three-year period ended October 1, 1936, numbered 195 for Shorthorns, an increase of 24; 155 for Guernseys, an increase of 35; 131 for Red Polls, an increase of 14; 103 for Jerseys, an increase of 10; but Friesians with 108 showed a decrease of 18. The highest yields certified for the various breeds were:—Friesian, 63,798 lb.; Red Poll, 53,334 lb.; Shorthorn, 43,318 lb.; Guernsey, 42,276 lb.; and Jersey, 40,498 lb.

Register of Dairy Cattle. Volume XX of the Register of Dairy Cattle was published in June, 1937, and contains

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particulars of the 766 cows in respect of which Certificates of Merit have been issued since the publication of Volume XIX, and also particulars of 16 pedigree bulls that qualified for entry on the basis of the yields given by their dams and sires' dams.

Testing for Butter-Fat. The Ministry's Scheme for Butter-fat Testing made further progress during 1935-36, the number of members having cows tested being 927, as compared with 854 in 1934-35. Testing was carried out in 1,020 herds containing nearly 31,000 cows, the number of cows actually tested being 12,597, an increase of 1,014 on the year. The Scheme is working smoothly, but owners of commercial herds are still reluctant to incur the extra expense of having individual samples taken regularly, and in 1935-36 over 82 per cent. of the herds tested consisted wholly or mainly of pedigree cattle. Table XVII shows the number of cows of each breed whose milk was tested under the Ministry's Scheme during the year.

TABLE XVII.—NUMBER OF COWS TESTED FOR BUTTER-FAT UNDER THE MINISTRY'S SCHEME DURING THE YEAR ENDED OCTOBER 1, 1936, CLASSIFIED ACCORDING TO BREED AND PERCENTAGE OF BUTTER-FAT.

Breed or type	Percentage of Butter-fat								Total number of cows tested	Average percentage of butter-fat
	Under 3	3 to 3.5	3.5 to 4	4 to 4.5	4.5 to 5	5 to 5.5	5.5 to 6	Over 6		
Ayrshire ..	11	231	553	298	37	3	—	—	1,133	3.78
Friesian ..	579	1,760	698	102	11	2	1	—	3,153	3.26
Guernsey ..	1	24	247	824	1,007	546	146	26	2,821	4.61
Jersey ..	1	3	33	222	501	509	305	113	1,687	5.04
Lincoln Red	5	53	89	25	2	—	—	—	174	3.62
Red Poll ..	41	205	315	119	11	3	—	—	694	3.62
Shorthorn ..	124	954	1,299	342	23	2	—	—	2,744	3.58
Other Breeds	3	21	84	65	14	4	—	—	191	3.92
TOTALS ..	765	3,251	3,318	1,997	1,606	1,069	452	139	12,597	3.89

The number of Shorthorns tested showed a small decrease, but Jerseys increased by nearly 400, while Friesians, Ayrshires, Guernseys, and Red Polls also showed increases. An average of over 5 per cent. of butter-fat was reached by 1,660 cows, practically all of which were Jerseys or Guernseys, as compared with 1,333 in 1934-35, while 3,603 averaged between 4 and 5 per cent. against 3,221 last year. The average percentage of butter-fat for all animals tested was

TABLE XVIII.—MILK RECORDING SOCIETIES
STATEMENT GIVING PARTICULARS OF THE 49 MILK RECORDING SOCIETIES OPERATING
DURING THE YEAR ENDED OCTOBER 1, 1936
(The Societies are arranged in order of total numbers of Cows recorded.)

Society	*No. of Members	No. of Herds	Total No. of Cows recorded	No. of Cows recorded for full year	Average yield of Cows recorded for full year
					lb
Essex County	259	305	12,863	6,607	8,534
Suffolk	307	344	10,528	5,736	8,139
East Sussex	254	285	9,158	4,613	7,148
Hampshire	187	220	8,027	3,849	7,250
Berkshire	179	207	7,678	3,942	7,253
Norfolk	197	220	6,874	3,061	8,357
Somerset and North Dorset	173	197	6,872	3,833	7,436
Hertfordshire County	182	200	6,439	3,378	8,051
Kent	131	156	5,197	2,608	7,352
West Sussex	126	143	4,852	2,365	7,536
Lancashire County	103	111	4,448	1,625	7,844
North Wilts	73	88	4,160	2,211	6,980
Surrey	126	138	4,096	1,953	7,099
Gloucestershire	118	130	3,856	1,966	7,921
Yorkshire	112	116	3,457	1,541	8,142
Oxfordshire	90	98	3,422	1,843	7,397
Leicestershire and Rutland	85	92	3,126	1,492	7,192
Buckinghamshire	99	106	3,099	1,496	7,722
Shropshire	69	74	2,949	1,420	7,715
Warwickshire	94	98	2,903	1,397	7,856
Cambridgeshire and District	83	95	2,837	1,501	7,801
Dorset	47	64	2,757	1,614	7,064
Staffordshire	77	79	2,665	1,225	7,851
Northamptonshire	71	77	2,536	1,163	7,176
Nottinghamshire	53	56	2,330	984	7,731
Cheshire County	55	57	2,200	1,070	7,744
Cumberland and North West- morland	81	84	2,148	875	6,514
Bristol and North Somerset	72	76	2,136	1,109	7,516
South Devon and District	92	93	2,060	938	6,653
Derby and District	56	58	1,981	830	9,099
South Wilts	35	43	1,926	1,182	7,590
Bedfordshire	55	57	1,896	886	7,846
Durham County	50	53	1,745	889	7,443
Peak (Derby)	56	57	1,611	668	8,211
Worcestershire	60	61	1,521	759	7,739
Northumberland	41	44	1,395	778	7,783
Lincolnshire	30	31	1,392	637	7,750
East Devon	44	44	881	509	6,609
Monmouthshire and Brecon	29	29	853	428	7,715
Kendal and South Westmorland Campden, Moreton and Dist. (Glos.)	30	31	788	321	6,245
Carmarthenshire	28	28	731	420	7,549
Cornwall	25	26	719	324	7,555
Denbighshire and Flintshire	42	42	705	410	7,030
Anglesey and Caernarvonshire	26	26	673	391	6,914
Herefordshire	45	45	627	391	5,633
Herefordshire	21	21	440	204	8,443
Cardiganshire	20	20	292	183	6,830
Pembrokeshire	12	12	220	134	6,876
Glamorgan	11	11	199	98	7,880
TOTALS	4,311	4,748	156,268	78,757	7,654

* Members recording Herds of Goats only are not included.

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3.89, while, as regards individual breeds, Jerseys were easily the highest with 5.04 per cent., followed by Guernseys with 4.61 per cent. and Ayrshires with 3.78 per cent.

Calf and Bull Marking. In 1935-36 more advantage was taken of the Ministry's scheme for the ear-marking and registration of calves of milk-recorded cows, and 16,454 calves were marked as compared with 15,233 in the previous year. Most of the calves marked were heifers, but more bull calves were marked than in any previous year, the number being 1,660 against 1,448 in 1934-35.

The number of bulls that were being used for service and that were ear-marked and registered by Societies for their members was 42.

Rationing. Reports received by the Ministry indicate that most members of Milk Recording Societies pay close attention to the rationing of their cows according to milk yield, and that good use is made of the advisory services available. Advice is generally sought from County Agricultural Organizers, whose assistance is often of great help to members in dealing with feeding problems.

Cost of Milk Recording. There was little change in the average cost of milk recording in 1935-36 as compared with the previous year; members paid an average of 4s. 1d. per cow and the Ministry's grants averaged 1s. 10d. per cow.

MARKETING NOTES

Milk Marketing Scheme. The wholesale price for liquid milk (other than Tuberculin Tested milk) in October, 1937, was 1s. 5d. per gal. The wholesale price for Tuberculin Tested milk was 1s. 7d. per gal.

Pool prices for October, 1937, are given below, with comparative figures for September, 1937, and October, 1936.

	<i>Pool Prices</i>		
	<i>Oct.</i> 1937	<i>Sept.</i> 1937	<i>Oct.</i> 1936
	<i>d.</i>	<i>d.</i>	<i>d.</i>
Northern	14	12½	13
North-Western	14	12½	13
Eastern ..	14½	12½	13½
East Midland	14½	12½	13
West Midland	13½	12	12½
North Wales	14	12	12½
South Wales	14	12½	12½
Southern ..	14½	12½	13½
Mid-Western	13½	12	12½
Far-Western	13½	12	12½
South-Eastern	14½	13	13½
Unweighted Average	14.05	12.39	12.91

These prices are exclusive of any premiums for special services and level deliveries, and also of the Accredited producers' premium of 1d. per gal. and, for October, 1937, the Tuberculin Tested producers' additional premium of 1d. per gal.

The accredited premium was paid on 27,205,225 gal., and the sum required for the payment of the quality premiums was equivalent to a levy of .348d. per gal. on pool sales.

The inter-regional compensation levy was fixed at 1½d. per gal., compared with 2½d. per gal. in October, 1936. Sales on wholesale contracts were as follows:—

	<i>Oct., 1937</i> <i>(estimated)</i>	<i>Oct., 1936</i>
	<i>Gal.</i>	<i>Gal.</i>
Liquid	52,252,772	47,654,469
Manufacturing	15,315,053	25,325,116
	67,567,825	72,979,585

Percentage liquid sales	77.33	65.30
Percentage manufacturing sales ..	22.67	34.70

The average realization price of manufacturing milk during October was 7.24d. per gal. compared with 5.77d. per gal. for October, 1936. The quantity of milk manufactured into cheese on farms was 2,077,424 gal. compared with 2,302,175 gal. in the previous month and 1,836,381 gal. in October, 1936.

Draft Sugar Beet Marketing Scheme. The promoters of

MARKETING NOTES

this Scheme have notified the Minister of Agriculture and Fisheries and the Secretary of State for Scotland that they do not wish to proceed with the Scheme.

Potato Marketing Scheme: Annual Election Meetings. The fourth annual general meeting of registered producers took place in London on October 28. At this meeting, the two retiring Special Members of the Board, Sir William G. Lobjoit and Mr. R. W. Halliday, were re-elected. Meetings for the election of district members were held on October 16, in the South-Western, South-Eastern, Eastern, Lincolnshire and East Midland districts. Of the retiring members who offered themselves for re-election, all were returned unopposed with the exception of the one for the South-Western district who was defeated. Capt. A. H. Maule Ramsay, M.P., has again been co-opted on to the Board.

Census of Stocks. A census of stocks on hand with registered producers and authorized merchants at midnight on November 6-7, has been taken by the Board, as in previous years.

Area under Potatoes in Great Britain. The Board have recently published a booklet, similar to that issued last year, showing the acreage, by counties, of each variety of early and maincrop potatoes grown in the years 1935, 1936 and 1937, by registered producers under the Scheme. Sketch maps showing the predominating varieties in the main producing areas have again been included.

The booklet is entitled "The Area under Potatoes in Great Britain, Miscellaneous Publications No. 5," and is obtainable from the Board, price 6d. post free.

Hops Marketing Scheme: Valuation of Crop. The whole of the 1937 crop has now been delivered into approved warehouses and valuation is proceeding. It is expected that this will be completed shortly, and that it will be possible to begin trading at a much earlier date than last year.

Milk Acts; 1934 to 1937: Cheese and Butter Milk Prices. For the purpose of payments under the Milk Acts (whether by the Exchequer to Milk Marketing Boards or by Boards to the Exchequer) in respect of milk used for manufacture, the Minister and Secretary of State for Scotland, with the approval of the Treasury, have certified the cheese-milk price and the butter-milk price to be 5.77 pence and 4.83 pence per gal. respectively for the month of September, 1937.

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Wheat Act; 1932: Sales of Home-Grown Wheat—Cereal Year, 1937-38. Certificates lodged with the Wheat Commission by registered growers during the period August 1 to November 5, 1937, cover sales of 6,965,689 cwt. of millable wheat as compared with 6,317,636 cwt. in the corresponding period (to November 6) in the last cereal year.

Sugar Industry (Reorganization) Act, 1936: Production of Home-Grown Beet Sugar during 1937-38 Campaign. According to information furnished by the British Sugar Corporation, Ltd., the total quantities of beet-sugar manufactured in Great Britain during October, 1937, and the corresponding month in 1936, were:—

		<i>White cwt.</i>	<i>Raw cwt.</i>	<i>Total cwt.</i>
1937	.. ..	845,642	1,001,582	1,847,224
1936	.. ..	1,422,223	1,159,698	2,581,921

Contracts for the Purchase of the 1938 Crop of Sugar-Beet. On November 1 the Sugar Commission issued the following statement:

Section 5 (1) of the Sugar Industry (Reorganization) Act, 1936, requires the British Sugar Corporation, Ltd., to enter into contracts for the purchase of sugar beet upon terms and conditions agreed between the Corporation and the representatives of sugar beet growers, or where agreement is not reached, upon such terms and conditions as may be determined by the Sugar Commission.

Negotiations between the Corporation and the National Farmers' Union on the subject of the beet contracts for 1938 were opened on September 16 last and the question was referred to the Sugar Commission for determination on October 20.

The Commission decided the terms and conditions of the contracts, and their Order, made on November 10, fixed the following prices for beet of the 1938 crop accepted for delivery at the factories named below. (The corresponding prices for 1937 are shown in brackets.)

<i>Factory</i>	<i>Beet Price per ton</i>	
	1938	1937
Bury St. Edmunds	43/-	(36/6)
Cantley	43/-	(36/-)
Ely	43/-	(36/6)
Ipswich	43/-	(36/6)
King's Lynn	43/-	(36/-)
Peterborough	43/-	(36/6)
Spalding	43/-	(36/6)
Wissington	43/-	(36/-)
Bardney	43/9	(36/6)
Colwick	43/9	(37/-)
Felstead	43/9	(36/6)
Kelham	43/9	(37/-)

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<i>Factory</i>	<i>Best Price per ton</i>
Allscott	44/6 (37/6)
Brigg ..	44/6 (37/6)
Kidderminster	44/6 (37/6)
Poppleton ..	44/6 (37/6)
Selby ..	44/6 (37/6)

The prices quoted above relate to beet properly topped and washed, having a sugar content of $15\frac{1}{2}$ per cent., and will be subject to an addition or deduction of 3d. per ton in respect of each 0.1 per cent. by which the sugar content is greater or less than $15\frac{1}{2}$ per cent. A bonus of 1s. 3d. per ton will be paid on all beet accepted by the Corporation for delivery to English factories in September, 1938, or after December 31, 1938, provided the grower has complied with the Clause in the Contracts regulating deliveries of beet.

The arrangement introduced in the 1937 contracts whereby the Corporation defrays railway freight charges in excess of 7s. per ton on all sugar beet accepted by the Corporation for delivery to the factories at Allscott and Kidderminster, will be continued for the 1938 season.

The preferential price for pulp sold by the Corporation to growers will again be fixed at £4 15s. per ton gross, corresponding to net prices to the grower of £4 5s. per ton for pulp delivered in October, 1938, £4 7s. 6d. in November, 1938, and £4 10s. in December, 1938.

The Commission's Order will not deal with the terms of the contracts for beet consigned to the Scottish factory at Cupar, which will be the subject of separate negotiations between the Corporation and the growers' representatives.

As a result of negotiations regarding the terms and conditions of the contracts for the purchase of the 1938 beet crop required by the Cupar beet-sugar factory, referred to in the preceding paragraph, the Sugar Commission issued the following statement on November 9:—

The terms and conditions of the Cupar contracts for 1938 have been discussed by the representatives of the Corporation and the National Farmers' Union of Scotland and the question was referred to the Sugar Commission for determination on November 4. The Commission have decided the terms and conditions of the 1938 contracts and an Order will be issued shortly fixing a price of 41s. per ton for beet with not more than 15 lb. tare per cwt. loaded into railway trucks at the grower's nearest railway station and consigned to the Cupar factory.

This price relates to beet properly topped and washed, having a sugar content of $15\frac{1}{2}$ per cent., and will be subject to an addition or deduction of 3d. per ton in respect of each 0.1 per cent. by which the sugar content is greater or less than $15\frac{1}{2}$ per cent.

The pulp clause will be revised in the 1938 contracts so as to provide that growers shall be entitled to pulp, up to a maximum of $1\frac{1}{2}$ cwt. per ton of beet consigned to the factory, at the preferential net prices of £4 5s. per ton for pulp delivered in October, 1938; £4 7s. 6d. in November, 1938; and £4 10s. in December, 1938, with the option to the grower of purchasing extra pulp up to 1 ton per contracted acre at prices 1s. per cwt. in excess of those quoted above.

Livestock Industry Act, 1937: Livestock Markets. Section 14 of the Act provides that, from the beginning of November this year, the approval of the Livestock Commission must be

MARKETING NOTES

obtained before any premises may be used as a livestock market which were not lawfully used for that purpose during the year ended November 30, 1936. Farm sales are expressly exempted from this provision, together with premises used for any class of sales which Ministers may decide to exempt by order. Such an Order* has now been made by Ministers exempting sales at agricultural shows of livestock that have been exhibited at such shows.

Cattle Fund. The following table gives particulars of payments made out of the fund set up under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936, and the Livestock Industry Act, 1937:—

<i>Period</i>	<i>Payments</i>	<i>Animals</i>	<i>Average Payment per Animal</i>	
			<i>£</i>	<i>s. d.</i>
April to October, 1935	2,194,879	929,892	2	7 2
April to October, 1936	2,269,261	976,563	2	6 6
April to October, 1937*	2,211,441	931,867	2	7 6
From commencement of subsidy payments to October 31, 1937	12,090,943	5,099,472	2	7 5

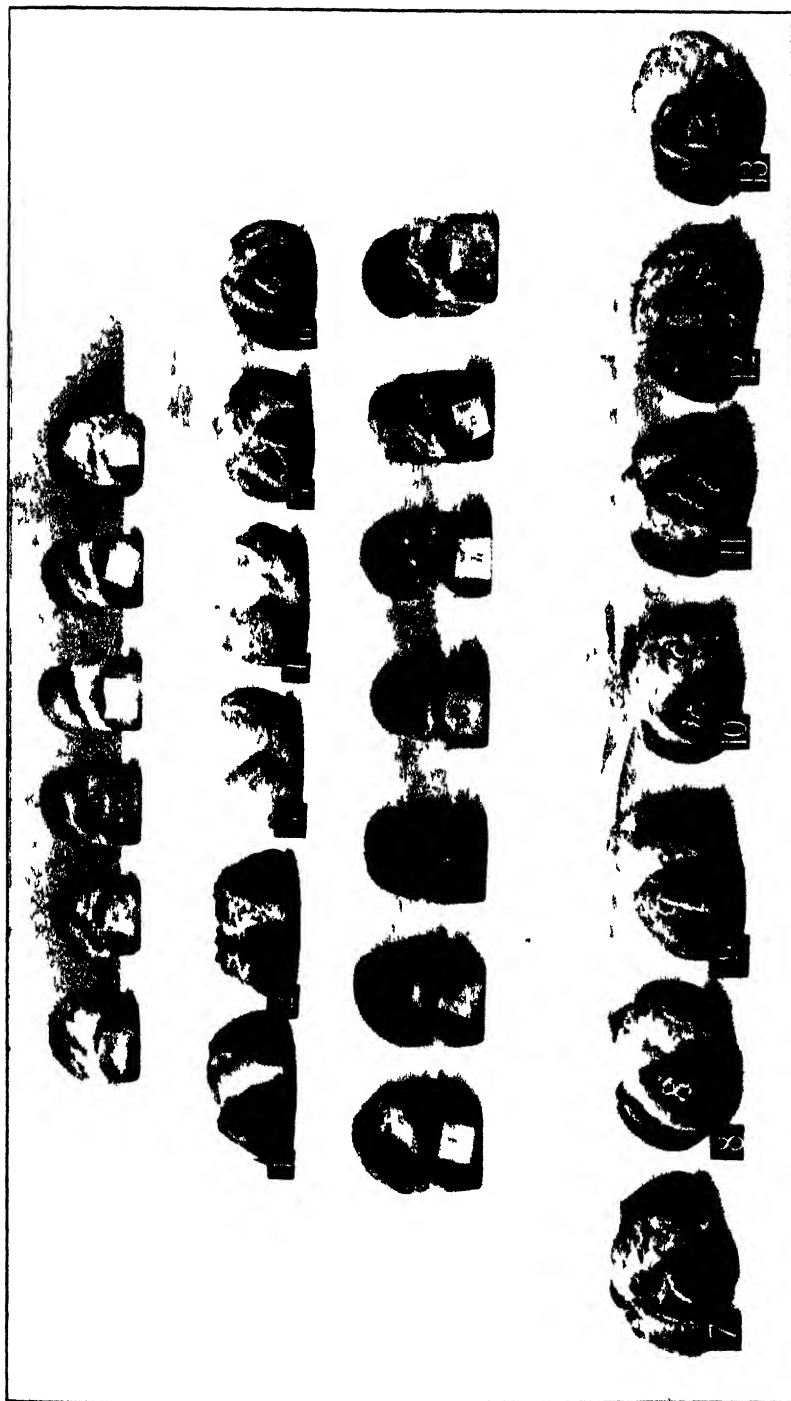
* The payments of the period, April to October, 1937, comprised £90,876 for 39,241 animals certified under the Emergency Provisions Acts, and £428,676 for 136,433 animals of quality standard and £424,979 for 213,764 animals of ordinary standard certified under the 1937 Act.

National Mark Egg Scheme. As a result of experiments conducted at the Forest Products Research Laboratory of the Department of Scientific & Industrial Research there has been evolved a method of packing eggs that permits of the use of fibre-board cases of lighter material than has hitherto been regarded as suitable for the purpose.

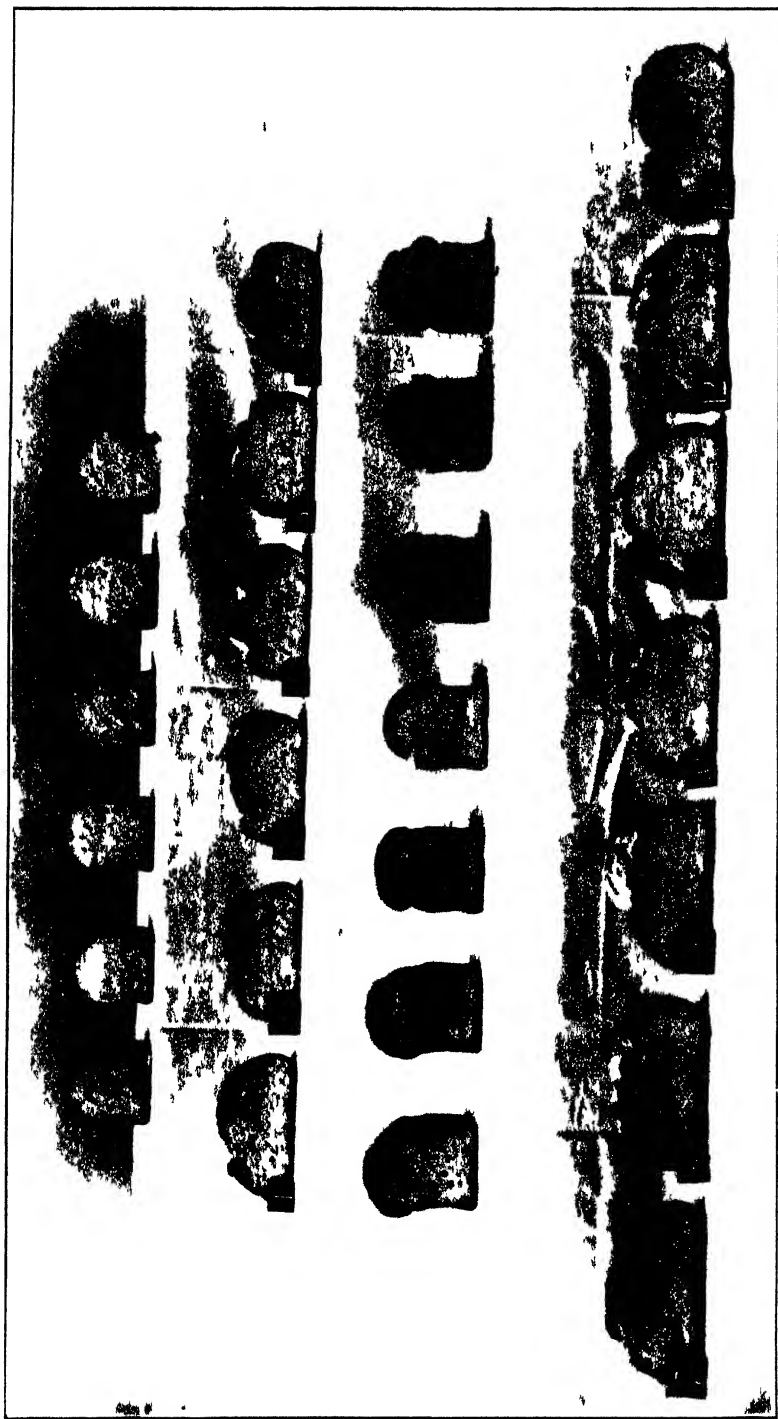
In the course of the experiments it was found that this reduction in the weight of material used for the outer container could safely be made provided that the internal fittings were such as to ensure the firm anchorage of the whole of the contents of the container, and specifications of such fittings have been prepared by the Laboratory. Manufacturers of containers and of fillers and flats have been invited to submit their products to the Laboratory for test, for which a scale of fees has been fixed. Certificates will be issued by the Laboratory in respect of containers and fittings that are found satisfactory under tests.

It has been decided that as from December 1, 1937, it shall be optional to packers in the National Mark Egg Scheme

* S. R. & O. 1937, No. 960. H.M. Stationery Office, price 1d.



Bread making tests carried out by the National Bakery School with samples of National Mark All English (Yeoman) Straights Flour, milled from 1937 crop Wheat. The test loaves uncut



Bread making Tests carried out by the National Bakery School with samples of National Mark All English (Yoman) Straights Flour milled from 1937 crop Wheat. The test loaves cut

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to use either cases and fittings made to the existing specifications or containers and fittings of the new type bearing a certificate of the Laboratory. Complete details of the new pack can be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

National Mark Dressed Poultry. The aggregate output of authorized packing stations during the nine months ended September 30, 1937, amounted to 1,064,000 birds, of which 304,000, or 29 per cent., were packed under National Mark labels. The total output of the packing stations for the corresponding period in 1936 amounted to 1,184,000 birds, with a National Mark output of 201,000 birds, or 17 per cent.

National Mark Dressed Poultry Trade Committee. The inaugural meeting of the re-constituted Poultry Trade Committee was held on September 15. Among the matters dealt with by the Committee was consideration of the special arrangements that it is proposed to make this year enabling producers to pack turkeys and geese under the National Mark Scheme. The Committee approved the arrangements made, which will function on similar lines to the arrangements made last year to meet the Christmas seasonal turkey and goose trade.

Home-Grown Wheat Flour for Bread Making. The National Bakery School has this year again conducted bread-making tests with National Mark All-English (Yeoman) Straights flour. The tests were made with 13 samples of flour milled from 1937 crop wheat by millers in various parts of the country. They indicate that in every instance satisfactory bread was produced from the samples tested. The photographs of the test loaves are shown on the accompanying inset.

The following observations are taken from the Director's report:—

1. Most of the flours possessed a good colour and produced bread with a creamish crumb; the uniformity of crumb colour was most marked again this year.
2. All the flours produced most stable doughs with the equivalent of 14½ gallons of water per sack. Most of the flours would carry 15 gallons per sack with safety.

During fermentation all the doughs gassed well and possessed good stability. They all possessed good dough handling properties.

3. Following the practice of previous years a 2½-hour bulk fermentation process was employed. All the flours produced good bread on this process.

MARKETING NOTES

4. As will be seen from the illustrations, all the flours produced bread of good volume, and were particularly satisfactory for oven bottom bread. Some samples were also baked into cottage bread and the results were most satisfactory—upstanding, bold loaves being obtained.

5. The stability of the flours was much greater than usual.

Copies of Marketing Leaflet 12e, giving the recipe for using National Mark flour in commercial bread-making, may be obtained from the Ministry free of charge.

National Mark Schemes for Cheese. The quantities of cheese packed under the National Mark in each of the schemes during the quarters ending June 30 and September 30, 1937, with comparative figures for the corresponding quarters of 1936, were as follows:—

Type of Cheese	Quarter ended June 30, 1937	Quarter ended June 30, 1936	Quarter ended Sept. 30, 1937	Quarter ended Sept. 30, 1936
	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>
Cheshire—				
(a) Farm made ..	16,297	14,566	22,285	20,020
(b) Creamery made ..	6,215	13,352	6,238	11,122
Caerphilly	6,313	6,203	5,904	5,971
Cheddar	138	739	1,342	1,431
Lancashire	2,822	* 2,207	4,759	4,921
Wensleydale	160	* 92	29	185
Leicester	223	* —	297	76
Stilton—				
(a) Blue	227	308	191	204
(b) White	330	640	318	693
Cream	17	* —	12	13
Derby	81	† —	185	† —

* These schemes came into operation during, or only shortly before, the period in question.

† Scheme not in operation until February, 1937

Marketing Demonstrations. Arrangements have been made for Demonstrations to be given at the following Fat Stock Shows during December:—

Show	Location	Date, 1937
Birmingham Fat Stock Show ..	Birmingham ..	Nov. 30 to Dec. 3.
Smithfield	Agricultural Hall, Islington.	Dec. 6 to 10.
Manchester	Manchester ..	Dec. 13 to 14.

At each of the Shows the operation of the scheme for the direct sale of fat stock on a grade and deadweight basis will be demonstrated.

Live animals will be exhibited in order to illustrate the types of animals that will kill out at the various carcass grades under the scheme.

DECEMBER ON THE FARM

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The present month does not usually afford great opportunity for progress with cultural operations. Short days and frequent rain limit the working hours considerably. Low temperatures and little sun mean little growth, and for this reason the present and succeeding month are not regarded as a favourable period for sowing. On many farms, if wheat has not been drilled before the end of November, sowing is delayed until February, when there is more likelihood of obtaining good plant establishment.

Practically all root-crops are cleared from the ground, except the last of the sugar-beet and root crops intended for consuming on the ground. Remarkable differences in climatic conditions in adjacent localities, which have so characterized the weather conditions of the past year, have been reflected in marked differences in the crops harvested. On the whole, 1937 stands out as a year when hay yields have been good. Pasturage in many parts has been abundant but not so uniformly good for the whole country as the hay crop.

A difficult winter and spring for cultural work on the land caused crops to be sown under poor soil conditions in many localities, with the result that there is much variation in the crops obtained. Wheat is probably the best cereal crop, oats in most instances have not done well, while barley crops are variable. It is probable that barley is the cereal that is most insistent on good soil conditions, and naturally this has been the most variable during the past season.

Potatoes, although planted under moderate conditions and frequently late, have finished a fair crop generally. There has been a tendency during the past twenty years for the potato crop to be grown only on the better soils. The standard of manuring and cultivation has also improved. All these factors help to bring up the crop to the average in an adverse season.

The late planting of sugar-beet has resulted in a short growing season, which is a disadvantage where maturity is desired.

Swedes and turnips are variable. In the north of England very few outstanding crops are met with, and where the crops

DECEMBER ON THE FARM

looked most promising in the early part of the season, the final result has not usually come up to expectations.

The poorer prospect for roots, together with the shortage of autumn grass in many districts, was no doubt responsible for the falling off in prices for store sheep during the latter part of the season.

Drainage. When wet conditions frequently hinder cultivations, labour may become available for other purposes, and some of this might be used to deal with drainage problems. The need for drainage is apparent on a large number of farms. Little under-drainage has been undertaken for many years, and drainage systems in many instances are worn out, or in need of repair. Wet land reduces the number of working days, makes tilth and seed bed more difficult to obtain, and encourages disease. While putting down new systems is an expensive matter, a great deal can frequently be done by attention to outlets, ditches, etc., this frequently releasing much trouble some water. On many farms where deep cultivation is not practised, a pan forms below the ploughed soil, and this tends to prevent water getting quickly to the drains. Subsoiling under such conditions often does good, not only by providing a greater area in which the plants may feed but by allowing surface water to get away more quickly.

Mole drainage has proved very useful and profitable on some soils, but it cannot be adopted satisfactorily on very large areas.

Before extensive pipe draining was undertaken in the country, drainage was effected by means of the rig and furrow system. A good open furrow running with the fall of the land can do much to clear water, and in planning winter ploughing it is desirable to make use of all opportunities to keep the land dry. Bad drainage limits the return from cultivations, manure and seed.

On a large number of farms the absence of a reliable plan of the drainage system results in much speculation and loss of time when a drainage question arises. It is advisable that a record of all drains and alterations should be kept.

Varieties of Cereals. Some years ago the National Institute of Agricultural Botany instituted a scheme for trials with different varieties of cereals. The trials are carried out by County Staffs at selected centres in the county. Valuable

DECEMBER ON THE FARM

information as to the suitability of varieties for the different districts has thus become available to the farmer. When such trials are carried out, the crop is carefully weighed and a reliable comparison of the varieties for the particular field and season is obtained. While the results show that certain varieties are generally superior to others, there are many instances of a variety being best suited to particular conditions. Growers should test the varieties that have shown the best results in their own district alongside the variety normally grown, to ascertain if a change is likely to be profitable. In making comparisons it is important that an accurate measure be taken. The varieties to be compared should be sown at the same time under the same conditions, and the resultant crop carefully weighed.

Comparisons between two varieties grown in separate fields should not be made without regard to variations of soil, manuring, time of sowing, previous cropping, etc.

A variety that "runs well" is frequently given much credit without any regard as to actual yield of grain or straw per acre. At Cockle Park this year a variety of oats appeared to be yielding well, as the grain ran freely from the threshers, but the actual yield of grain per acre was the same as another variety that did not run so well. In both, the yield of grain was $23\frac{1}{4}$ cwt. per acre, but with one the yield of straw was $23\frac{1}{4}$ cwt. while with the other it was 30 cwt. On the other hand, to judge by bulk of crop in the field may be most misleading. One variety that looked well produced $33\frac{1}{4}$ cwt. of straw, but yielded only $9\frac{1}{4}$ cwt. of grain. The estimation of grain crops can only be within relatively wide limits, often so wide as not to allow for what may be the difference between profit and loss. It takes time and trouble to weigh, but it is worth while if it enables the farmer to find the most profitable variety.

Grass Land. Where there is much rough unconsumed grass, every effort should be made to have it pulled off before growth commences in spring. Where this can be done with cattle and sheep it is an advantage. Matted grass land can never be productive. Heavy harrows and other grass land implements can be used to displace the mat. This, however, is not sufficient, as the mat frequently settles down again. Raking up and burning and encouraging decomposition by treading with stock are means of clearing it out of the way.

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but it is necessary to follow these up by adequate spring and summer grazing. In wet weather, undue poaching by stock frequently does serious harm. The surface soil is left in very bad physical condition, with the result that the pasture or meadow is less productive during the following season.

Wet grass land can often be improved without drainage. In the north of England, much undrained grass land that was originally in a waterlogged condition, growing rushes and showing other signs of lack of drainage, has been considerably improved by the application of phosphatic manures. For summer grazing, this land does very well and compares favourably with much of the pipe-drained land. The more vigorous growth of the pasture plants with deeper rooting enables the surface water to get more readily to the sub-soil. There is less water shed off to accumulate in the furrows and low-lying areas, with the result that the rushes have practically disappeared. It should, however, be pointed out that the undrained land is not very suitable for wintering stock as it poaches readily and the stock do not get a dry lying place.

Cattle. During the month, many of the earlier fattening cattle will be marketed. It is the month for fat stock shows. If the large shows such as Smithfield, Edinburgh, Birmingham and Norwich are the gathering centres for the larger feeders, the local shows maintain the interest of the smaller feeders. The encouragement given by these shows for feeders to turn out an article of high standard is a great advantage, even if, as may be so in extreme instances, the economic aspect is not so satisfactory.

Young cattle are now being reared on a number of farms where, in the past, the cattle requirements have been purchased either as dairy cows or stores ready for fattening. A visit to many rearing farms as well as to our markets for store cattle reveals the fact that numbers of animals do not come up to the desired standard. Both breeding and feeding affect the type and standard of animal produced. At birth, the animal has certain potentialities that it has derived from its parents, but the proper development of these depends on feeding and management. Young growing animals need a suitably balanced ration for the satisfactory development of bone, muscle, blood tissues, etc. Over-feeding is undesirable as affecting the future economic life of the animal by unnecessarily increasing the cost of producing the store animal. On the other

DECEMBER ON THE FARM

hand store cattle are too frequently relegated to a very secondary place as far as food and management are concerned, with the result that poor returns are obtained and inferior animals produced.

The winter season is sufficiently far advanced for producers of store cattle to be able to judge how far satisfactory progress is being made by store cattle, and where necessary changes in food and management should be made. On hill farms, ewes often lose weight during the winter owing to poor diet. With mature sheep this may be unavoidable and yet economic, but as far as young growing sheep are concerned hill flockmasters are careful to winter them on low ground under better conditions. Similarly with growing cattle, it is important that they should be kept in thriving condition. Apart from the question of food supply, the general management affects their well-doing. Housing conditions are frequently bad. Light, air, freedom from draughts are as important as a dry bed. The spring and summer progress of cattle may be as much affected by the conditions of housing, etc., during winter as by the food supply.

General. Lambing commences amongst Down flocks on some farms during the month. On self-supporting grass farms it is delayed until there is available pasturage for the nursing ewes. On hill farms grass begins growth much later, and lambing is therefore delayed until the end of March or April. The conditions for hill flocks are most severe during January to March, and a sharp look-out needs to be kept for ewes that are not thriving, and help should be given before serious falling off in condition occurs.

A certain amount of the winter food supply has already been consumed, and now is a good time to take account of remaining stocks and to make any necessary alteration in the rations so that the best use may be made of the food available.

NOTES ON MANURING

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Loss of Lime from Soils. An estimated annual loss of 4 to 5 cwt. of lime (CaO) per acre from manured plots on Broadbalk field at Rothamsted has often been taken as a rough indication of the rate at which lime is lost from the soil. That circumstances may greatly affect the rate of loss, however, is shown by results from other centres. For instance, Woburn, starting with a much lower content of lime than Broadbalk, still contained one-half of the original supply after 50 years of cropping, though the whole of its lime content would have been completely exhausted in less than 20 years if the loss had proceeded at the same rate as on Broadbalk. There is now no doubt that the actual amount of lime in a soil greatly influences the rate at which lime is lost. Other factors also affect the rate of loss. Under conditions of high rainfall the rate of loss normally increases. Again, the system of manuring may increase the loss of lime, e.g., where it includes frequent large dressings of sulphate of ammonia continued over a long period of years. On the other hand, manuring may conserve the supplies of lime in the soil, e.g., where farmyard manure or the so-called physiologically alkaline or slightly basic fertilizers, such as nitrate of soda, calcium cyanamide, basic slag, etc., form the chief basis of the manuring programme.

Nevertheless it is desirable, if possible, to attempt to form a general idea as to the length of time a given dressing of lime may be expected to last in general farming practice. For this purpose it is necessary first to explain that different sorts of lime all serve the same purpose in the soil, namely to replenish and maintain the supplies of calcium. Calcium is present in the soil in a number of different chemical combinations, but only two of these are important to our problem, namely calcium carbonate and calcium present in loose combination with the humus and clay particles and called the exchangeable calcium. No matter what sort of lime or chalk is applied to the soil, chemical changes will eventually convert it into one or other of these two forms.

The amount of exchangeable calcium present in any soil will depend (1) on the amounts of clay and humus in the soil, and

NOTES ON MANURING

(2) on the extent to which these are "saturated" with calcium. A soil that contains free calcium carbonate may be assumed to have its clay and humus "saturated" with calcium; if not, saturation will gradually take place by drawing on the free calcium carbonate, as happens when chalk, for instance, is applied to an acid soil. In other words, the calcium carbonate acts as a reserve and it is only when this reserve has become exhausted that further loss of lime leaves the clay and humus "unsaturated" and the soil becomes increasingly acid.

It follows from the fact that the exchangeable calcium is associated with the clay and humus that heavy and peaty soils when "saturated" contain much more exchangeable calcium than sandy soils. Crop failure occurs at some particular *degree* of "unsaturation," and hence, though a small loss of lime may cause serious crop failure on a very light soil, a small dressing of lime will put it right. On the other hand, when a heavy soil is sufficiently acid to cause crop failure it requires a much heavier application of lime to put it right again.

Mention has already been made of the heavy loss of lime from the manured plots on Broadbalk field at Rothamsted on a soil containing a good proportion of free carbonate of lime.

At Harper Adams, on a light loam soil, originally acid with a "lime requirement" of 2 tons CaCO_3 per acre, Morley Davies showed that the rate of loss of added carbonate of lime increased with the rate of application. All trace of free carbonate of lime disappeared within 4 to 6 years of application. Even plots that received 5 tons per acre carbonate of lime contained no free CaCO_3 at the end of six years; some of the added lime had been washed out and the remainder converted into the exchangeable form.

Determinations of the exchangeable calcium in the soil showed that the annual loss of lime over the first seven years from the date of liming was at the high rate of 3 cwt. CaO per acre from plots which received 5 tons carbonate of lime per acre; $1\frac{1}{2}$ cwt. CaO per acre where $2\frac{1}{2}$ tons of carbonate was applied; and only $\frac{1}{2}$ cwt. per acre where $1\frac{1}{4}$ tons of carbonate of lime was applied. Hence during the years immediately following an application of lime the rate of loss is high if the quantity applied greatly exceeds the amount required to correct the acidity of the field.

Examination of the present lime status of the very light sandy soil at Tunstall, East Suffolk, suggests that following an application of 5 tons per acre of lump chalk in 1926 to a soil

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with a lime requirement of about 30 cwt. CaCO_3 per acre, the average loss of lime during the period 1926-1937 has been at the rate of about $1\frac{1}{2}$ to $1\frac{3}{4}$ cwt. CaO per acre per annum. In this instance free calcium carbonate persisted in the soil longer than at Harper Adams, but the small amounts of clay and humus in this soil required relatively little calcium to "saturate" them and hence a large proportion of the added chalk remained as free calcium carbonate.

Evidence obtained by Rice Williams at Bangor, from medium loam soils in North Wales, also showed a definite tendency for the rate of loss of lime to increase with the exchangeable calcium present. This is interesting, because none of these Welsh soils contained any free carbonate of lime and the losses of lime were therefore the average losses from "unsaturated" soil without any addition of lime to affect the rate of loss in the early years. The average annual loss of lime from soils with a good content of exchangeable CaO was 157 lb. CaO per acre as against an average annual loss of only 75 lb. per acre on soils poor in exchangeable CaO . In other words the soils with the highest exchangeable CaO content lost lime at twice the rate of those with a low exchangeable content. The average annual loss for all the Bangor soils was 106 lb. exchangeable CaO per acre per annum, with 224 lb. per acre as the highest individual loss.

Experiments on a light sandy soil at Woburn show the following losses of lime over a period of fifty years:—

<i>Manuring</i>	<i>Loss of Exchangeable CaO in 50 years</i>
Nil	34 cwt per acre
Mineral manures alone	23
Minerals plus sulphate of ammonia	53
Minerals plus nitrate of soda	24
Farmyard manure	17

These figures also show that different systems of manuring have a pronounced effect on the loss of lime.

Considering the evidence from all centres, soils with a high lime status, i.e., "saturated" and containing free carbonate of lime, are likely to suffer relatively heavy annual losses of lime—probably from 3 to 5 cwt. CaO per acre per annum. This loss will occur irrespective of whether the high lime status is of long standing or has been recently induced by the application of dressings of chalk or lime greatly in excess of the lime requirement.

The rate of loss will decrease as the lime status of the soil

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deteriorates, and, on non-calcareous or slightly acid soils, or on more acid soils that have been limed with a dressing approximately sufficient to fulfil their lime requirement, the rate of loss is not likely to exceed $1\frac{1}{2}$ to 2 cwt. CaO per acre per annum. On soils of still lower lime status the annual loss will fall until it reaches an almost negligible amount, but such soils are usually too acid for satisfactory growth of many of the common agricultural crops.

If we accept the intermediate type as about the lowest lime status at which most farmers require to keep their soils (unless they are prepared to adopt rotations restricted to such crops as oats, potatoes, rye and lupins) then it seems that the annual loss will be about $1\frac{1}{2}$ to 2 cwt. CaO per acre. It has already been pointed out that this will vary slightly with manuring, rainfall, soil type, etc., but taking the higher figure as the best on which to base a safe estimate it seems that in general the most economical liming policy for lime-deficient soils is first to give them a dressing of lime in accordance with their lime requirement and subsequently to apply 10 cwt. per acre of ground burnt lime or about 17 cwt. per acre of ground carbonate of lime every 5 years. Where, however, a cheap source of waste lime or of lump chalk is available locally it is usually better, in the long run, to give relatively heavier dressings of this material than those suggested above, despite the possibility of a higher rate of loss, for 4 to 5 tons per acre of undried sugar-beet factory lime sludge or lump chalk is about the smallest dressing that can be spread on the land anything like uniformly, and uniform spreading is essential to success in all liming operations. The price of these bulky materials is usually such that they are still often the most economical form of lime when they can be bought locally.

Since a large proportion of the total loss of lime takes place via the drainage water it might be supposed that the additional and deeper cultivations performed on arable land would lead to greater losses on arable than grass land. Such evidence as there is, however, suggests that the difference is not very great under ordinary farming conditions, and in view of the importance of maintaining a high lime content in both pasturage and hay for the sake of the health and productivity of the livestock consuming them, grassland farmers should be prepared to replace losses of lime of the same order as those mentioned above for arable land, unless, of course, they regularly use heavy dressings of basic slag.

NOTES ON MANURING

Phosphate and Seedling Growth. (a) *In the Field.* Reference is often made to the beneficial effects of phosphate on the growth of young seedlings. On soils that are deficient in available phosphate, crops will usually show a definite response to phosphatic fertilizers throughout the whole season. On soils less markedly deficient, an application of phosphate sometimes produces visible beneficial effects in the early stages of growth but little or no increase in yield at harvest. Evidence of such effects with the sugar-beet crop was given in these notes for March, 1937. Two fields, one rich and the other poor in available phosphate, were sown with sugar-beet. Both showed visible responses in the *seedling stage* of the crop to applications of superphosphate, but only the one poor in phosphate showed any appreciable increase in yield at lifting time. It is not wise, however, to ignore an early response even if an increase in yield does not always follow. A vigorous seedling will often survive a spell of unfavourable conditions which might seriously check or even prove fatal to a weaker plant.

Another instance of the beneficial effect of phosphate on seedling growth is the well known effect of a dressing of basic slag on the establishment of a young "seeds" layer.

(b) *Under Glass.* In glasshouse work, however, fertilizers are often deliberately omitted from composts and soils for seed sowing, etc., on the grounds that a too liberal supply of plant food in the early stages is likely to produce weak growth and not a sturdy plant. Investigations by Lawrence and Newell at the John Innes Horticultural Institution at Merton, however, have shown that a judicious application of fertilizer, especially phosphate, to the compost in which seeds are sown will not only give more vigorous growth in the seedling stage but also, in certain circumstances, is well-nigh essential to the production of a sturdy plant. The experiments covered a variety of pot plants, as well as turnip and tomato seedlings, so that the results must have a wide application in practice.

Beneficial effects were obtained from an addition of superphosphate to unsterilized soil but the effects were even more pronounced when steam-sterilized soil was used. Troubles caused by fungi and bacteria have led to an increase in the adoption of steam sterilization of soil and compost for boxing or potting. Though this treatment usually controls many disease troubles, seeds sown in freshly-sterilized soil often suffer a serious check in the early stages of growth, a difficulty

NOTES ON MANURING

that, in the past, has been partly overcome by storing the soil for some time after sterilization. Even when the soil has been stored for two or three months after sterilizing, however, seedling growth may be slow in the early stages if no fertilizer is mixed with the soil.

Experiments at Merton with different fertilizers showed that a great improvement in early growth resulted from mixing superphosphate with steam-sterilized compost, but addition of nitrogen in the form of hoof and horn meal, or potash in the form of sulphate of potash, gave no better growth during the first few weeks than superphosphate alone, and, in general, it seemed best to mix the superphosphate with the soil or compost *after* rather than before sterilizing. Potash proved more important as the plants reached maturity, and though probably unnecessary for a compost for seed sowing and pricking off, should be included with nitrogen and phosphate in composts for potting.

It is particularly interesting to note that, though some benefit was obtained when superphosphate was used in conjunction with *unsterilized* soil for seed sowing the benefit was very much greater when steam-sterilized soil was used. It seems therefore that the actual process of steam sterilizing a soil leads to an increase in the amount of phosphate required to produce strong and vigorous growth in seedlings growing in that soil. The reason for this is not easy to find. Lawrence and Newell have shown that during steam sterilizing a harmful interaction takes place between the ingredients of a compost, especially if lime in any form is added before sterilizing. Steam sterilization is generally believed to increase the amount of available nitrogen in the soil, but it is not yet clear whether this disturbance of the balance of plant nutrients is the only factor involved in the increase in the phosphate requirement of the soil. The important point to bear in mind is the desirability of ensuring an adequate supply of phosphate to seedlings whether grown in the field or in the nursery. A small quantity of phosphatic fertilizer should always be mixed with soil used for growing seeds in boxes and for pricking on. This is particularly important where the soil has been steam sterilized. Superphosphate at the rate of $1\frac{1}{2}$ oz. per bushel of compost proved a satisfactory source of phosphate for the seed sowing and potting composts used at Merton.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended Nov. 17				
	Bristol	Hull	L'pool	London	Cost per Unit ¶
Nitrate of Soda (N.15½%) ..	£ 8 0c	£ 8 0c	£ 8 0c	£ 8 0c	s. 10 4
" " Granulated (N.16%) ..	8 0c	8 0c	8 0c	8 0c	10 0
Nitrate of Lime (N.13%) ..	7 7e	7 7e	7 7e	7 7e	11 4
Nitro-Chalk (N.15½%) ..	7 10c	7 10c	7 10c	7 10c	9 9
Sulphate of Ammonia :—					
Neutral (N.20·6%) ..	7 8c	7 8c	7 8c	7 8c	7 2
Calcium Cyanamide (N.20·6%) ..	7 10d	7 10d	7 10d	7 10d	7 3
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 4	5 1	5 0	5 1	3 5
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%) ..	8 10	8 8	8 5	8 8	3 4
Sulphate. " (Pot. 48%) ..	10 2	10 0	9 17	10 0	4 2
Basic Slag (P.A. 15½%) ..	2 12b	2 5b	—	2 10b	3 2
" " (P.A. 14%) ..	2 8b	2 0b	2 0b	2 6b	3 3
Grd. Rock Phosphate (P.A. 26— 27½%) ..	2 17a	2 15a	2 15a	2 12a	2 0
Superphosphate (S.P.A. 16%) ..	3 4	—	3 3f	3 0g	3 9
" " (S.P.A. 13½%) ..	3 1	2 17	2 19f	2 16g	4 1
Bone Meal (N. 3½%, P.A. 20½%) ..	—	7 5	7 5h	7 2	—
Steamed Bone Flour (N. ½%, P.A. 27½–29½%) ..	5 5i	5 10	5 0h	4 15	—

Abbreviations : N. = Nitrogen ;
S.P.A. = Soluble Phosphoric Acid ;

P.A. = Phosphoric Acid ;
Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 5-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 5 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra and for lots of 4 cwt. and under 1 ton, 20s. extra.

e For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, for lots of 1 ton and under 2 tons, 7s. 6d. per ton extra, and for lots of under 1 ton, 20s. extra.

f Prices shown are f.o.r. Widnes.

g Prices shown are f.o.r. northern rails; southern rails, 1s. 3d. extra.

h Prices shown are f.o.r. Appley Bridge.

i Price shown is f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent. nitrogen, contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Winter Keep (continued). *Forage Crops.* In last month's Notes we discussed the varied nutritive possibilities of grass-land produce, fresh or preserved. Turning now to consider the produce of the arable land, the obvious substitutes or supplements for grass would seem to be the various green fodder crops, such as the kales, rape and cabbage. In chemical composition they do in fact closely resemble average grass, such as a good pasture affords in the late spring or early summer. Disregarding the relatively small differences between the individual crops the average composition of the dry matter of these crops is roughly as given below:—

COMPOSITION OF DRY MATTER

					<i>Green Fodders</i> %	<i>Extensive Grazing</i> %
Crude Protein	..	..	..	..	16	17
Oil (Ether Extract)	..	..	..	..	4	4
Carbohydrates (N-free Extract)	..	..	..	..	50	49
Fibre	..	..	..	..	19	20
Ash	..	..	..	..	11	10
Starch Equivalent	..	..	..	..	59	56

The concordance with the grass average is very close and would seem to justify the conclusion that the dry matters of the grass and of the fodders may be taken as equal in nutritive value. Whereas, however, the former crop commonly contains 20 per cent. of dry matter, the average for the forage crops is only about 14 per cent., so that on green weight the latter should have about two-thirds of the feeding value of the grass. There may also be a little difference in the make-up of the minerals of the two classes of crop, although this will vary considerably. On average composition the kales are rather richer in lime than average grass or cabbage. Rape is rather richer in protein than kale, but less concentrated in productive energy (starch equivalent)..

In the marrow stem kale crop the leaves are more nutritious

NOTES ON FEEDING

than the stems, the average composition of the dry matter being much as set out below:—

	<i>Leaf</i>	<i>Stem</i>
	%	%
Crude Protein	14	9
Oil (Ether Extract)	3	1
Carbohydrates (N-free Extract)	56	56
Fibre	12	25
Ash	15	9

The richness of the leaf in ash may be noted, the outstanding ingredients of it being lime, potash and chlorine.

Under " forage crops " must also be included the tops and crowns of the sugar-beet crop. These contain about 15 per cent. of dry substance, the composition of which roughly resembles that of the other forage crops in containing 15-20 per cent. of crude protein. Published analyses generally show a similarly high proportion of ash, but a considerable part of this is probably due to the adherent soil. In one sample recently tested, the dry matter contained 21.6 per cent. of ash, of which 8 per cent. undoubtedly arose from dirt. This emphasizes the necessity, where beet tops are fed, of protecting them as far as possible from soil contamination. In Germany, where beet tops are extensively ensiled or dried, it is the usual practice to wash the tops first. Further precaution is necessary in the feeding of beet tops owing to the presence of a small proportion of oxalic acid. In the sample referred to above this amounted to about 2 per cent. of the dry matter, which is high for a material that may act as a poison. The proportion seems to be reduced if the tops are allowed to wilt for a few days before feeding, and a further safeguard is to feed a little ground chalk or limestone ($\frac{1}{4}$ lb. per 3 cwt. beet tops) along with them to ensure that the oxalic acid will be converted to the insoluble, harmless form of calcium oxalate. A more extensive description of the various forage crops will be found in the Ministry's Bulletin No. 13.

Root Crops. Next to the green fodders in apparent suitability to take the place of succulent grass come the various root crops, such as turnips, mangolds, carrots and potatoes, to which may be added sugar-beet pulp, since this is an integral part of a root crop. The suitability is more apparent than real, however, since the only points that these crops share in common with grass are succulence and palatability. It is true that they share the further characteristic of being bulky, but this is due to their peculiar structure and the high proportion

NOTES ON FEEDING

of water with which their cells are filled, and not to a high proportion of fibre as with grass. A comparison of the composition of the dry matter of the two classes of material brings out very clearly that the dry matter of roots is something very different from that of grass, and approximates, indeed, far more closely to that of barley and oats:—

COMPOSITION OF DRY MATTER

	Roots	Grass (as above)	Barley	Oats
	%	%	%	%
Crude Protein	8-11	17	12	12
Oil (Ether Extract)	$\frac{1}{2}$ -1 $\frac{1}{2}$	4	2	5
Carbohydrates (N-free Extract)	70-80	49	78	67
Fibre	5-10	20	5	12
Ash	4-8	10	3	4
Starch Equivalent per 100 lb. dry matter	50-75	56	84	68

For the sake of simplicity data have been given for " roots " as a class, but the variation between the individual crops makes it necessary to show the range rather than to give an average that would be meaningless.

It will be seen that as a class " roots " furnish dry matter that is much poorer in protein, ether extract, fibre and ash, and correspondingly richer in carbohydrates, than that of grass. On the other hand, it closely resembles the dry matter of the cereals, the chief differences being in a slightly lower protein and higher ash. The fibre content is mostly intermediate between that of barley and oats, but it is of a more digestible type.

It would appear logical, therefore, to regard the root crops as providing a " carbohydrate concentrate " mixed with a large proportion of water. Viewed in this light the function of roots in rationing will be to effect economies in the use of cereals and other starchy concentrates in the " production " ration. The ratio of water to dry matter varies greatly in the different classes of roots, being on the average about 3 : 1 in potatoes, 7 : 1 in carrots, mangolds and swedes, and 10 : 1 in soft turnips. Potatoes show the closest resemblance to the cereals, since their chief carbohydrate is starch, whereas in the " roots " it is one or more forms of sugar. For production purposes, especially in the ruminant, sugar is less valuable than starch, and this explains why the starch equivalent of the dry matter of " roots " (55-65 per cent.) is rather lower than that of potatoes and the cereals.

Sugar-beet pulp differs from the roots in having had its

NOTES ON FEEDING

sugar and soluble minerals removed, although in " molassed pulp " part of the sugar will have been restored in the form of molasses. The dry matter of the pulp is thus poorer than that of untreated roots in soluble carbohydrates, and correspondingly richer in fibre, but its general feeding qualities still resemble those of " roots " with a starch equivalent in the region of 55-65 per cent. for the dry matter. (See also Bulletin No. 13).

Straws. The function of the various types of straw in the " winter keep " programme is obvious and requires little comment. At its best straw may be equal to fair quality hay; at its worst it is little more than " ballast," and probably gives better value if trodden into manure than if passed through the animal, since in the latter circumstance only about one-half of the organic matter of the straw will reach the manure heap.

The nutritive value of straw varies somewhat according to the crop, but is mainly determined by the degree of ripeness of the plants when cut, and the labour of mastication and digestion imposed by the degree of hardness and toughness of the straw. Straw of a relatively soft character from a crop cut in the early stages of ripening will be more nutritious than if it comes from " dead-ripe " plants. Other things being equal, a tough, good-standing variety of straw will probably be less nutritious than a softer type. It is probable, therefore, that the straw from modern varieties of cereals is usually inferior as fodder to that from the older varieties not bred for stiffness of straw.

It is generally agreed that oat straw is the best feed of the cereal straws, although in some districts practical opinion favours wheat straw. Much depends upon the ripeness of the crop at cutting, and the less forward ripening of the oat crop when usually cut probably largely accounts for its superiority over the riper straws from barley and wheat, whose " goodness " has been more largely transferred into the grain.

The feeding value of the haulm from beans and peas is affected by the same conditions of ripeness and physical character as the cereal straws. Both contain about twice as much protein, and at their best have a rather higher feeding value. Their physical character is more variable, however, and it is this quality more often than not that determines whether they are worth feeding.

NOTES ON FEEDING

The chaff or "cavings" arising from the threshing of the grain crops has much the same nutritive character as the straws, apart from broken corn and weed seeds that may be present. These would tend to raise the feeding value, but if the proportion of weed seeds is more than very small the good husbandman will prefer burning this material to either feeding it or incorporating it in the manure.

Corn. The chemical nature and nutritive qualities of the various cereal and leguminous grains grown on our farms are probably better understood than those of any other home-grown feeding materials and therefore need only a brief reference. They all rank as "concentrated" foods and share in common the quality of containing a high proportion of easily digestible carbohydrates, mainly in the form of starch. As to protein, the cereal grains contain 8-12 per cent., and the leguminous grains (beans and peas) 22-26 per cent. For most of our farm feeding (young growing stock, milking stock of all kinds, laying hens, etc.) we usually require a "production ration" of concentrates containing 16-18 per cent. of protein, which is intermediate between the cereals and legumes, so that the farmer with both leguminous and cereal grains at his disposal need have no difficulty in making up "balanced" rations from his home-grown produce if he so desires, although prices in the feeding-stuffs market may often point to more economic methods of meeting his requirements.

One point in particular must be kept in mind in using cereals freely, namely, their relative poverty in protein and lime. For the feeding purposes indicated above a mineral supplement relatively rich in lime will almost invariably be desirable with rations containing a high proportion of cereals, unless the other foods in the ration (e.g., good hay, fish meal) are so outstandingly rich in lime as to make good the deficiency of the cereals. Even beans and peas, though relatively much richer in lime than cereals, are not sufficiently so to give a complete safeguard, and a mixture of beans and cereals will still as a rule require mineral supplement.

As between the different cereals oats are characterized by containing about three times as much oil as barley or wheat, or even more if the comparison is made on the naked grain. This advantage of the kernel of the oat is offset, however, by the practical necessity of feeding the husk along with it, which results in the feeding value of the oat "as fed" being about

NOTES ON FEEDING

10-15 per cent. lower than that of wheat and barley, which are much the same. One practical advantage of the oat is its safety, which makes it possible, if desired, to feed larger quantities than would be safe with other grains. Barley, in this and other respects, ranks intermediate between oats and wheat, the free use of the latter (apart from cost) being subject to restriction owing to its tendency to form doughy masses in the digestive organs. For this reason it is generally recommended that wheat be only coarsely ground if more than a small proportion is to be included in the ration.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British.. ..	9 3	0 9	8 14	72	2 5	1·29	9·6
Barley, British Feeding	9 0½	0 8	8 12	71	2 5	1·29	6·2
" Canadian No. 3							
Western	8 13	0 8	8 5	71	2 4	1·25	6·2
" Argentine ..	8 17½	0 8	8 9	71	2 5	1·29	6·2
" Persian ..	8 7½	0 8	7 19	71	2 3	1·21	6·2
" Russian ..	8 13½	0 8	8 5	71	2 4	1·25	6·2
Oats, English, white ..	9 0	0 9	8 11	60	2 10	1·52	7·6
" " black							
and grey	8 13	0 9	8 4	60	2 9	1·47	7·6
" Scotch, white ..	10 0	0 9	9 11	60	3 2	1·70	7·6
" Canadian—							
No. 2 Western..	10 7*	0 9	9 18	60	3 4	1·79	7·6
No. 3 Western..	9 15½	0 9	9 6	60	3 1	1·65	7·6
Mixed feed ..	9 2	0 9	8 13	60	2 11	1·56	7·6
Maize, Argentine ..	7 7	0 7	7 0	78	1 10	0·98	7·6
" South African—							
No 2 White ..	6 18½	0 7	6 11	78	1 8	0·89	7·6
No. 4 Yellow..	7 2½	0 7	6 15	78	1 9	0·94	7·6
Beans, English, Winter	7 15½	0 17	6 18	66	2 1	1·12	19·7
Peas, English, blue ..	11 12½	0 15	10 17	69	3 2	1·70	18·1
" Japanese..	21 15½	0 15	21 0	69	6 1	3·26	18·1
Milling Offals:—							
Bran, British ..	7 10	0 16	6 14	43	3 1	1·65	9·9
" Broad ..	8 5	0 16	7 9	43	3 6	1·87	10·0
Middlings, fine,							
imported	8 5	0 13	7 12	69	2 2	1 16	12·1
Weatings† ..	8 12	0 15	7 17	56	2 10	1·52	10·7
" Superfine †	9 0	0 13	8 7	69	2 5	1·29	12·1
Pollards, imported ..	8 0	0 15	7 5	50	2 11	1·56	11·0
Meal, barley ..	10 0	0 8	9 12	71	2 8	1·43	6·2
" " grade II ..	9 5	0 8	8 17	71	2 6	1·34	6·2
" maize ..	7 17	0 7	7 10	78	1 11	1·03	7·6
" " South African	7 5	0 7	6 18	78	1 9	0·94	7·6
" " germ ..	7 10	0 11	6 19	84	1 8	0·89	10·3
" locust bean ..	7 15	0 6	7 9	71	2 1	1 12	3·6
" bean ..	9 7	0 17	8 10	66	2 7	1·38	19·7
" fish (white) ..	15 0	2 5	12 15	59	4 4	2·32	53·0
" Soya bean							
(extracted)†	9 17	1 11	8 6	64	2 7	1·38	38·3
Maize, cooked, flaked ..	8 7	0 7	8 0	84	1 11	1·03	9·2
Linseed cake—							
English, 12% oil ..	10 12	1 1	9 11	74	2 7	1·38	24·6
" 9% " ..	10 0	1 1	8 19	74	2 5	1·29	24·6
" 8% " ..	9 15	1 1	8 14	74	2 4	1·25	24·6
Cottonseed cake—							
English, Egyptian							
seed, 4½% oil ..	6 0	0 19	5 1	42	2 5	1·29	17·3
Cottonseed cake,							
Egyptian, 4½% oil ..	5 12	0 19	4 13	42	2 3	1·21	17·3

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein. equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Cottonseed cake, decorticated, 7% oil	8 7†	1 9	6 18	68	2 0	1·07	34·7
Cottonseed meal, decorticated, 7% oil	8 5†	1 9	6 16	70	1 11	1·03	36·8
Coconut cake, 10% oil	7 15†	0 18	6 17	77	1 9	0·94	16·4
Ground nut cake, 6-7% oil ..	7 10*	0 19	6 11	57	2 4	1·25	27·3
Ground nut cake, decorticated, 6-7% oil	9 7*	1 9	7 18	73	2 2	1·16	41·3
Ground nut cake, imported decorticated, 6-7% oil ..	8 0	1 9	6 11	73	1 10	0·98	41·3
Palm-kernel meal, 1-2% oil ..	7 0	0 12	6 8	71	1 10	0·98	16·5
Feeding treacle ..	5 0	0 8	4 12	51	1 10	0·98	2·7
Brewers' grains, dried ale	6 7	0 11	5 16	48	2 5	1·29	12·5
Brewers' grains, dried porter ..	6 0	0 11	5 9	48	2 3	1·21	12·5
Dried sugar beet pulp..	From £5 os. 0d. to £5 7s. 6d. per ton, ex-factory (according to factory).						

* At Bristol.

§ At Hull.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE: The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the beginning of November, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 1s. per ton as shown above, the cost of food value per ton is £9 19s. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1·43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 4d.; P₂O₅, 2s. 7d.; K₂O, 3s. 8d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow:—

				<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	..	..	..	71	6.2	8 12
Maize	..	..	..	78	7.6	7 7
Decorticated ground-nut cake	..	..	..	73	41.3	8 13
„ cotton-seed cake	..	..	..	68	34.7	8 7
(Add 10s. per ton, in each instance, for carriage.)						

The cost per unit starch equivalent works out at 2.22 shillings, and per unit protein equivalent 0.62 shilling. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent Per cent.	Protein equivalent Per cent.	Food Value per ton, on farm £ s.
Wheat	72	9.6	8 6
Oats	60	7.6	6 18
Barley	71	6.2	8 1
Potatoes	18	0.8	2 0
Swedes	7	0.7	0 16
Mangolds	7	0.4	0 16
Beans	66	19.7	7 19
Good meadow hay	37	4.6	4 5
Good oat straw	20	0.9	2 5
Good clover hay	38	7.0	4 9
Vetch and oat silage	13	1.6	1 10
Barley straw	23	0.7	2 11
Wheat straw	13	0.1	1 9
Bean straw	23	1.7	2 12

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, price 6d., post free 7d.

CATTLE INDUSTRY (EMERGENCY PROVISIONS) ACTS, 1934 TO 1936: NUMBER, WEIGHT & PRICES OF CATTLE CERTIFIED FOR PAYMENTS

Previous issues of this *Journal* have contained information regarding the cattle and carcasses of cattle certified for payments under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936, from the inception of the Subsidy Scheme on September 1, 1934, to the end of February, 1937.* Subsidy payments under those Acts came to an end on July 31, 1937, and as from August 1, 1937, subsidy payments have been made in accordance with the revised Scheme made under the provisions of Part II of the Livestock Industry Act, 1937. The particulars given in this article complete the information available regarding the emergency Scheme.

The total numbers of each class of animal certified for subsidy in each of the five months March to July, 1937, are given in Table I, and are compared with the numbers in the corresponding months of 1936:—

TABLE I

Month	Steers		Heifers		Cow-Heifers		Total	
	1937	1936	1937	1936	1937	1936	1937	1936
March ..	97,124	99,721	50,272	48,062	6,356	6,051	153,752	153,834
April .	90,646	95,833	42,150	41,645	6,394	5,463	139,190	142,941
May ..	92,017	91,130	41,222	37,433	6,350	5,393	139,589	133,956
June ..	74,229	81,685	42,999	47,729	6,584	6,148	123,812	135,562
July ..	64,980	65,807	59,392	58,199	6,506	5,990	130,878	129,996
Total (5 months)	418,996	434,176	236,035	233,068	32,190	29,045	687,221	696,289

In the period of five months now under review the number of cattle certified was 9,068 (1.3 per cent.) less than in the corresponding period of 1936. As the great majority of fat stock markets are held on the early days of the week the rate of marketing of fat cattle cannot be judged accurately from the number of animals marketed in a calendar month. In Table II, therefore, these figures have been adjusted so as to allow as far as possible for the fact that a large number of markets are held on Mondays and that the number of markets held decreases

* See footnote on p. 912.

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day by day as the week proceeds. It would appear from these adjusted figures that the rate of marketing of cattle eligible for subsidy was lower in March, 1937, than in March, 1936, by 2.9 per cent.; in April by 1.2 per cent.; in May by 2.5 per cent.; and in June by 4.1 per cent.; but that in July, 1937, it was higher by 3.1 per cent. The increase in July may have been accounted for by the presentation of an unusually large number of imported cattle, which, if presented in the following month, might under the new subsidy scheme have qualified for subsidy only at a reduced rate.

TABLE II

			1937	1936
March	.	..	139,494	143,732
April	..	..	144,547	146,373
May	.	.	137,042	140,519
June		..	121,550	126,686
July		.	134,623	130,604

It is of interest to note that changes in the numbers of each class of animal varied appreciably. The number of steers decreased by 3.5 per cent. in the five months February to July, 1937, compared with the corresponding five months in 1936, while the numbers of heifers and cow-heifers increased by 1.3 per cent. and 10.8 per cent. respectively. Cow-heifers, however, accounted for only 4.7 per cent. of the total number of animals certified.

A comparative statement of percentages of the different classes of animals certified in each month is given in Table III :

TABLE III

	Steers		Heifers		Cow-Heifers	
	1937	1936	1937	1936	1937	1936
	%	%	%	%	%	%
March ..	63.2	64.8	32.7	31.4	4.1	3.8
April ..	65.1	67.0	30.3	29.3	4.6	3.7
May ..	65.9	68.0	29.5	28.1	4.6	3.9
June ..	60.0	60.1	34.7	35.5	5.3	4.4
July ..	49.6	50.3	45.4	45.2	5.0	4.5
Five months .	61.0	62.3	34.3	33.5	4.7	4.2

Live-Weight Certifications. Of the total of 687,221 animals certified at Live-weight and Dead-weight Centres in the five months March to July, 1937, 663,885 were certified at Live-

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weight Centres. Details of the numbers of each class of animal certified at Live-weight Centres in each of the agricultural divisions, into which the country is divided are given in Table X (p. 912).

Table IV shows the numbers of animals certified at Live-weight Certification Centres in England, Wales, Scotland, Northern Ireland and the United Kingdom respectively in the period under review compared with the corresponding period in 1936:—

TABLE IV

	March-July			
	1937		1936	
	Number	Per cent.	Number	Per cent.
England	445,398	67·1	438,312	64·7
Wales	22,958	3·4	25,139	3·7
Scotland	151,199	22·8	160,462	23·7
Northern Ireland ..	44,330	6·7	53,390	7·9
United Kingdom ..	663,885	100	677,303	100

In the United Kingdom as a whole the number of animals certified at Live-weight Centres in the period March to July, 1937, declined by 2.0 per cent. as compared with the corresponding months in 1936. The numbers certified in England increased by 1.6 per cent., but in Wales they declined by 8.7 per cent., in Scotland by 5.8 per cent., and in Northern Ireland by 17.0 per cent.

In England the largest percentage increase in numbers certified was in the North-Eastern Agricultural Division where, in the period under review, there was an increase of 6.6 per cent., as compared with the corresponding period of 1936. Increases of from 2.7 to 3.8 per cent., were shown in the East Midland, West Midland, and Northern Divisions, but there was a reduction of 8.5 per cent. in the South-Eastern Division, and smaller reductions in the Eastern, South-Western and North-Western Divisions.

In Wales the percentage decrease was about equal in the Northern and Southern Divisions.

In Scotland there was an increase of 3.7 per cent. in the numbers certified in the South-Eastern Division, but there were

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reductions in all the remaining Divisions, ranging from 3.9 per cent. in the North and North-West to 9.8 per cent. in the East Central Division.

Dead-weight Certifications. During the period under review 23,336 animals were certified at Dead-weight Centres, as compared with 18,986 in the corresponding period of 1936, an increase of nearly 23 per cent. The increase was mainly in Scotland, where certifications rose by 84 per cent., but there was also an increase of 8 per cent. in England and Wales.

Comparative particulars for each country are given in Table V:—

TABLE V

	England and Wales		Scotland		Great Britain	
	1937	1936	1937	1936	1937	1936
March .. .	3,545	3,040	1,148	612	4,693	3,652
April .. .	3,736	3,012	1,473	592	5,209	3,604
May .. .	3,105	3,206	1,489	761	4,594	3,967
June .. .	2,671	2,827	1,312	817	3,983	3,644
July .. .	3,548	3,249	1,309	870	4,857	4,119
Total for five months	16,605	15,334	6,731	3,652	23,336	18,986

Average Weight of Fat Cattle. The average live-weight (after a deduction of 28 lb. had been made for subsidy payment purposes) at which fat cattle were marketed in the United Kingdom as a whole in the five months March to July, 1937, was 9 cwt. 1 qr. 11 lb., which was 1 lb. heavier than in the corresponding period of 1936. The average live-weight for

TABLE VI

	Average weights over five months March to July					
	1937			1936		
	cwt.	qr.	lb.	cwt.	qr.	lb.
England and Wales ..	9	1	10	9	1	9
Scotland .. .	9	2	20	9	3	3
Northern Ireland ..	8	0	24	8	0	13
United Kingdom ..	9	1	11	9	1	10

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each of the five months was March, 1937, 9 cwt. 2 qr. 2 lb.; April, 9 cwt. 1 qr. 23 lb.; May, 9 cwt. 1 qr. 9 lb.; June, 9 cwt. 0 qr. 23 lb.; and July, 9 cwt. 0 qr. 22 lb. The weights for March, April and May were slightly heavier than those in the corresponding months a year earlier, the weight in June was slightly less, while in July it was unchanged. Table VI shows the average weights for the period under review for each country separately with similar averages for the corresponding period of 1936.

The average dressed carcass weights of the animals certified at Dead-weight Certification Centres in the five months March to July, 1937, are given in Table VII and compared with the corresponding period in 1936. It will be observed that in Great Britain as a whole the average carcass weight was 15 lb. heavier than in 1936, and that the increase was mainly at Scottish Centres.

TABLE VII

	Average weight over five months, March to July	
	1937	1936
England and Wales	lb. 614	lb. 610
Scotland	667	631
Great Britain	629	614

Average Prices of Fat Cattle. It will be seen from Table VIII that the average price per live cwt. of certified cattle showed a substantial improvement in each month of the

TABLE VIII

	England & Wales		Scotland		Northern Ireland		United Kingdom	
	1937 s. d.	1936 s. d.	1937 s. d.	1936 s. d.	1937 s. d.	1936 s. d.	1937 s. d.	1936 s. d.
March ..	37 11	35 2	39 2	36 4	34 4	32 4	37 11	35 2
April ..	40 6	35 11	41 9	37 0	37 10	31 11	40 7	35 11
May ..	43 11	36 11	45 9	37 6	43 2	33 1	44 4	36 10
June ..	44 9	39 1	46 11	40 3	43 2	35 4	45 3	39 2
July ..	43 9	38 4	49 6	40 3	41 11	34 1	44 10	38 6
5 months March - to July	42 1	37 0	44 4	38 3	39 2	33 3	42 5	37 1

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period March to July, 1937, as compared with the corresponding period of 1936, and that over the whole of the United Kingdom the average price for the five months was 42s. 5d. per live cwt. as compared with 37s. 1d. in 1936.

Prices per cwt. dressed carcass weight improved similarly, the average for the five months being 70s. 10d. per cwt. as compared with 63s. 10d. in 1936. In Table IX average prices per cwt. dressed carcass weight where certification took place on a dead-weight basis are given for each month and compared with the corresponding month a year earlier : —

TABLE IX

					1937	1936
					s. d.	s. d.
March	.	..	..	..	63 7	61 4
April	..	..	..	..	66 11	61 2
May	72 4	62 11
June	75 4	65 8
July	77 10	67 3
Five months, March to July ..					70 10	63 10

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TABLE X.—NUMBER OF CATTLE CERTIFIED FOR PAYMENT UNDER THE CATTLE INDUSTRY (EMERGENCY PROVISIONS) ACTS AT LIVE-WEIGHT CERTIFICATION CENTRES IN EACH MONTH FROM MARCH TO JULY, 1937.*

Agricultural Divisions		Steers					Heifers				
		March	April	May	June	July	March	April	May	June	July
ENGLAND (excluding Monmouth)	East ..	4,975	5,497	6,162	5,391	4,526	2,741	2,536	2,421	2,212	2,649
	North-East ..	15,773	18,100	19,120	15,245	10,241	3,753	4,100	4,388	4,178	3,577
	South-East ..	1,760	1,558	1,638	1,256	1,209	2,016	1,794	1,680	1,720	1,900
	East Midlands ..	4,519	4,280	3,853	3,669	7,218	3,728	2,855	3,039	4,769	8,191
	West Midlands ..	5,430	4,875	5,350	3,890	2,213	5,324	4,035	4,186	4,487	5,186
	South-West ..	3,995	3,828	3,415	2,841	2,731	3,999	3,434	3,218	3,787	4,640
SCOTLAND	North ..	14,604	13,355	14,098	9,403	6,874	7,623	5,840	6,139	7,143	13,566
	North-West ..	3,891	3,339	3,321	2,344	2,385	5,237	4,339	3,625	4,068	7,517
Total ..		54,947	54,832	56,957	44,039	37,397	34,421	28,933	28,696	32,364	47,223
WALES (including Monmouth)	North ..	1,881	1,074	817	584	1,298	940	539	451	462	936
	South ..	1,717	1,359	973	844	884	1,722	1,120	968	1,206	1,589
	Total ..	3,598	2,433	1,790	1,428	2,182	2,662	1,659	1,419	1,668	2,525
SCOTLAND	North-East ..	5,370	5,287	5,396	4,026	3,155	5,463	5,207	5,099	3,832	3,907
	East Central ..	7,964	7,645	8,959	7,324	5,667	1,633	1,520	1,808	801	515
	South-East ..	6,357	4,611	5,457	5,289	4,059	302	257	362	319	176
	West & South-West ..	4,863	4,128	3,478	3,271	3,476	1,386	1,074	815	1,000	1,494
	North & North-West ..	916	797	857	726	672	583	468	464	403	453
Total ..		25,410	22,468	24,147	20,636	17,029	9,361	8,526	8,548	6,445	6,545
NORTHERN IRELAND Total		10,008	7,258	5,908	5,413	5,365	2,561	1,825	1,470	1,599	1,510
TOTAL UNITED KINGDOM		93,963	86,991	88,802	71,516	61,973	49,005	40,943	40,133	41,986	57,803

* Details of the monthly figures from September, 1934, to February, 1935, are given on pp. 144 and 145 of this *Journal* for May, 1935; from March, 1935, to May, 1935, on p. 467 of this *Journal* for August, 1935; from June to August, 1935, on p. 799 of this *Journal* for November, 1935; from September, 1935, to February, 1936, on pp. 148 and 149 of this *Journal* for May, 1936; from March, 1936, to August, 1936, on pp. 784 and 785 of this *Journal* for November, 1936; and from September, 1936, to February, 1937, on pp. 150 and 151 of this *Journal* for May, 1937.

CATTLE INDUSTRY (EMERGENCY PROVISIONS) ACTS, 1934-36

TABLE X (continued) —NUMBER OF CATTLE CERTIFIED FOR PAYMENT UNDER THE CATTLE INDUSTRY (EMERGENCY PROVISIONS) ACTS AT LIVE-WEIGHT CERTIFICATION CENTRES IN EACH MONTH FROM MARCH TO JULY, 1937

Agricultural Divisions		Cow-Heifers					Total				
		March	April	May	June	July	March	April	May	June	July
ENGLAND (excluding Monmouth)	East ..	124	109	114	140	120	7,840	8,142	8,697	7,743	7,295
	North-East ..	167	212	211	229	213	19,693	22,412	23,719	19,632	14,031
	South-East ..	166	161	173	146	146	3,942	3,513	3,491	3,122	3,255
	East Midlands ..	426	402	423	483	610	8,673	7,537	7,315	8,921	16,019
	West Midlands ..	502	512	458	544	409	11,256	9,422	9,994	8,921	7,802
	South-West ..	967	1,065	1,113	1,139	1,095	8,961	8,327	7,746	7,767	8,466
	North ..	922	943	1,099	959	1,189	23,149	20,138	21,336	17,505	21,632
ENGLAND (including Monmouth)	North-West ..	1,704	1,634	1,533	1,584	1,443	10,832	9,312	8,479	7,996	11,345
	Total ..	4,978	5,038	5,124	5,224	5,225	94,346	88,803	90,777	81,627	89,845
WALES (including Monmouth)	North ..	94	104	92	102	85	2,915	1,717	1,360	1,148	2,319
	South ..	280	228	191	225	193	3,719	2,707	2,132	2,275	2,666
	Total ..	374	332	283	327	278	6,634	4,424	3,492	3,423	4,985
SCOTLAND	North-East ..	127	98	84	116	134	10,960	10,592	10,579	7,974	7,196
	East Central ..	19	34	34	16	12	9,616	9,199	10,801	8,231	6,194
	South-East ..	21	18	22	27	17	6,680	4,886	5,841	5,635	4,252
	West & South-West ..	258	215	198	249	282	6,441	5,417	4,491	4,520	5,252
	North & North-West ..	18	21	16	24	24	1,517	1,286	1,337	1,153	1,149
NORTHERN IRELAND	Total ..	443	386	354	432	469	35,214	31,380	33,049	27,513	24,043
	Total	296	291	299	344	273	12,865	9,374	7,677	7,266	7,148
TOTAL UNITED KINGDOM ..		6,091	6,047	6,060	6,327	6,245	149,059	133,981	134,995	119,829	126,021

The Agricultural Divisions comprise the Counties of:—

ENGLAND—
East: Bedford, Huntingdon, Cambridge, Suffolk, Essex, Hertford, Middlesex and London.
North-East: Norfolk, Lincoln and York.
South-East: Kent, Surrey, Sussex, Berkshire and Hampshire.
East Midlands: Nottingham, Leicester, Rutland, Northampton, Buckingham, Oxford and Warwick.
West Midlands: Salop, Stafford, Worcester, Shropshire and Hereford.
South-West: Dorset, Devon and Cornwall.
North: Northumberland, Durham and York.
North-West: Lancashire, Cheshire, Derby and Stafford.

WALES—
North: Anglesey, Carmarvon, Merioneth, Montgomery, Denbigh and Flint.
South: Cardigan, Radnor, Brecon, Monmouth, Glamorgan, Carmarthen and Pembrokeshire.
SCOTLAND—
North-East: Nairn, Moray, Banff, Aberdeen and Kincardine.
East Central: Angus, Perth, Fife, Clackmannan and Kinross.
South-East: West Lothian, Midlothian, East Lothian, Berwick, Roxburgh, Selkirk, Peebles, Shetland, and Orkney.
West and South-West: Argyll, Bute, Dumfriesshire, Stirling, Lanark, Renfrew, Ayr, Dumfries, Kirkcubright and Wigton.
North and North-West: Zetland, Orkney, Caithness, Sutherland, Ross and Cromarty and Inverness.

MISCELLANEOUS NOTES

The Agricultural Index Number

The general index number of prices of agricultural produce for October is 131 (base, October 1911-13=100), or 6 points lower than a month ago but 6 points above that for October, 1936. If allowance be made for payments under the Wheat Act, 1932, and the Livestock Industry Act, 1937, the revised index for the month becomes 134. Prices of wheat, barley, oats, pork pigs, eggs, butter, milk, cheese and potatoes were higher although in some instances the relative indices declined, owing to proportionately greater increases having occurred during the base period. Quotations for fat cattle and sheep, hay and wool moved downwards.

Monthly index numbers of prices of Agricultural Produce. (Corresponding months of 1911-13 = 100)

Month	1932	1933	1934	1935	1936	1937
January	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	140
May	115	102	112	111	115	133
June	111	100	110	111	116	131
July	106	101	114	114	117	131
August	105	105	119	113	119	133
September	104	107	119	120	127	137
October	100	107	114	113	125	131
November	101	109	114	113	125	—
December ..	103	110	113	114	126	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and for the Cattle subsidy (b).

Month	1932	1933	1934	1935	1936	1937
January	—	111	119	124	125	133
February	—	110	117	122	123	133
March	—	106	112	118	122	134
April	—	109	116	126	128	143
May	—	105	116	117	120	136
June	—	104	114	117	121	134
July	—	104	117	120	121	134
August	108	108	122	120	124	136
September	108	111	125	128	133	142
October ..	104	112	121	119	129	134
November ..	105	113	120	119	129	—
December ..	107	114	120	120	130	—

(a) Commenced August, 1932.

(b) Commenced September, 1934.

In the following table the monthly index numbers of prices of individual commodities are shown for the months of July

MISCELLANEOUS NOTES

to October, 1937, October, 1936, and October, 1935; base, the corresponding months of 1911-13=100.

Commodity	1937				1936	1935
	Oct.	Sept.	Aug.	July	Oct.	Oct.
Wheat	124	114	118	120	113	80
Barley	148	147	147	127	119	110
Oats	124	125	125	121	99	89
Fat cattle	111	115	119	114	95	92
„ sheep	134	138	141	145	131	121
Bacon pigs	124	124	120	117	114	90
Pork	131	125	119	115	119	99
Eggs	136	141	138	144	141	118
Poultry	133	130	132	130	115	117
Milk	171	202	175	175	171	171
Butter	111	109	110	112	98	95
Cheese	122	124	126	128	101	82
Potatoes	153	147	127	142	202	152
Hay	86	95	97	95	102	91
Wool	140	146	147	143	102	89
Dairy cows	120	117	114	115	107	107
Store cattle	111	113	119	120	95	90
„ sheep	129	138	142	139	132	120
„ pigs	164	153	141	133	150	124

Revised index numbers due to payments under the Wheat Act and to the Cattle subsidy.

Wheat	134	132	124	123	134*	122
Fat cattle	126	130	134	128	109	107
General Index	134	142	136	134	129	120

* Superseding figure previously published. *

Grain. Wheat, at an average of 9s. 2d. per cwt., was higher on the month by 7d. and the index advances by 10 points. (If the deficiency payment under the Wheat Act, 1932, is taken into account the index is 134.) Quotations for barley at 12s. 7d. per cwt. and those for oats at 8s. 7d. per cwt. showed a rise of 4d. and 2d. respectively; the relative indices are, however, little altered. In October, 1936, wheat averaged 8s. 5d., barley 10s. 1d. and oats 6s. 10d. per cwt.

Livestock. Prices of fat cattle continued to decline and, at 37s. 4d. per live cwt. for second quality, were lower than in the preceding month by 1s. 2d., the index falling by 4 points to 111. The addition of the subsidy under the Livestock Industry Act, 1937, brings the index to 126. Fat sheep at 9½d. per lb. for second quality, were reduced by ¼d. per lb., this being reflected in a fall of 4 points in the index. Baconers

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again averaged 12s. 8d. per score (20 lb.) and the index also is unchanged; quotations for porkers, however, at 14s. 2d. per score advanced by 7d., the index appreciating by 6 points.

Dairy cows and store pigs were again dearer on the month and the relative indices move upwards by 3 and 11 points respectively. Prices of store cattle and store sheep were little changed but, owing to the movement of prices during the corresponding months of 1911-13, the index for the former falls by 2 points and for the latter by 9 points.

Dairy and Poultry Produce. During October the regional contract price of liquid milk advanced by 2d. per gal. but the index is reduced by 31 points to 171, the seasonal increase during the base period being greater. Butter at 1s. 3½d. per lb. averaged ¾d. per lb. more than in the previous month but as this increase was almost counterbalanced by the rise in the base price, the index appreciates by only 2 points. The upward movement in the price of eggs continued, second quality averaging 18s. 11d. per 120 compared with 16s. 10d. in September; the base price, however, showed a proportionately larger increase and the index recedes by 5 points. The price and index of cheese at £4 11s. per cwt. and 122 were little changed and compare with £4 9s. 6d. and 124 of a month ago. Quotations for fowls and ducks were unaltered while geese made more money; a rise of 3 points is recorded in the combined index for poultry.

Other Commodities. Potatoes at £5 10s. per ton were slightly higher in price and, due principally to a reverse movement in the base price, the index appreciates by 6 points. Quotations for both clover and meadow hay were lower and the combined index shows a decline of 9 points. The price of wool was again reduced, the index receding by 6 points.

Rural Housing Report

The Second Report* of the Rural Housing Sub-Committee of the Central Housing Advisory Committee recommends the grant of a general Exchequer subsidy to local authorities for new houses built for the agricultural population—a subsidy sufficient to enable a substantial proportion of the new houses to be let at rents of not more than 3s. a week, exclusive of rates. It also recommends that a similar subsidy, payable annually, should be available to private persons to

* Second Report of the Rural Housing Sub-Committee of the Central Housing Advisory Committee Ministry of Health. Obtainable through a bookseller or from H.M. Stationery Office. Price 9d. (by post 10d.).

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build cottages for agricultural workers as long as these cottages are let at agricultural rents.

The report points out that the difficulty underlying the provision of proper housing for farm workers is that these workers are not able to pay the economic rent of a new house, or to compete in this respect with industrial workers or other persons in better economic circumstances. In consequence, the latter tend to squeeze out the agriculturist in any area where they form a substantial part of the population. Several witnesses before the Committee referred to the serious and increasing shortage of competent agricultural labour, one of the main causes of which is the lack of suitable housing accommodation.

The report recommends that new houses should be built as far as possible in existing villages. The Committee consider that with modern transport facilities the disadvantage to the bread-winner of having to travel to his work is outweighed by the great advantage to his family of being near school, shops, and other centres of social intercourse. Building in villages rather than in isolated groups also facilitates the best and most economical use of public services like water supply and sewage disposal.

The report recommends that the Housing (Rural Workers) Acts, by which grants are made available to private persons for the improvement of existing cottages for agricultural workers, should be continued. It also contains several useful recommendations on minor points designed to make these Acts more easily workable. It is suggested that local authorities should undertake surveys in their districts to discover what cottages are suitable for reconditioning, and should then endeavour to persuade the owners of such cottages to take advantage of the facilities afforded by the Acts to carry out the work.

Seed Potatoes

The following note has been communicated by the National Institute of Agricultural Botany:—

Potato growers who are considering the purchase of seed for next year's planting should obtain the leaflet on seed potatoes which the National Institute of Agricultural Botany issues free of charge direct to farmers or through the County Agricultural Authorities.

Despite the encouragement given to potato breeding by the Ministry of Agriculture and the Scottish and Irish Departments

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of Agriculture for many years, over 90 per cent. of the potato acreage grown in Great Britain is still planted with varieties that have been on the market for more than twenty years. Allowing for the reluctance of the growers to discard those varieties with whose qualities they are familiar, they could in most instances grow some of the newer varieties with benefit. Some of the old varieties are susceptible to wart disease and possess other faults, such as poor shape and indifferent cooking quality, while they are subject to second-growth. On the other hand, the new varieties are immune from wart disease and are only recommended after careful trial.

New Varieties. In the first-early class *Arran Pilot* is confidently recommended as a substitute for Ninetyfold, Epicure, Duke of York, and Sharpe's Express in many districts. It is an early bulker, the tubers are of excellent kidney shape and not prone to cracking or second-growth, the flesh and skin are white, the eyes shallow and the cooking quality good. It is, however, somewhat susceptible to virus diseases and it is essential to obtain healthy seed. To maintain healthy stocks in England, growers should obtain details of the work carried out by the National Institute of Agricultural Botany at Ormskirk on the production of reasonably virus-free seed in Lancashire.

Doom Early is recommended as a substitute for Epicure. It is a blunt-oval in shape, bulking several days earlier than any other variety in commerce, and is an eminently suitable variety to grow for the opening of the first-early trade in Great Britain.

The second-early or mid-season class is now filled with varieties that also serve as maincrops or winter potatoes, e.g., *Majestic*, *King Edward* and *Arran Banner*. The search for improved substitutes for *King Edward* and *Majestic* is still in progress.

Gladstone, a variety similar to *King Edward* in maturity, colour and shape of tubers, has recently been grown with considerable success in many districts. The quality is at least equal to that of *King Edward*.

Redskin is suggested as a substitute in districts where *Kerr's Pink* is grown. The tubers are similar in shape to those of *Kerr's Pink*, though the eyes are more shallow. Its cropping power and cooking quality are good, and it has the advantage of maturing some three weeks earlier. Unlike *Kerr's Pink*, it is not subject to second-growth.

Arran Signet produces a heavy crop of kidney tubers of excellent shape, and matures about the same time as *Majestic*.

Dunbar Standard is a late maincrop that produces a heavy crop of white kidney tubers of excellent quality.

Arran Cairn is another late maincrop that produces a very heavy crop of white kidney tubers of good quality.

It is earnestly suggested that growers should plant at least small quantities of some of the newer kinds so that they can test for themselves the value of the recommendations made.

MISCELLANEOUS NOTES

Report by the Food Council on Costs and Profits of Retail Milk Distribution in Great Britain

The Food Council have made a report to the President of the Board of Trade on the subject of the costs and profits of retail milk distribution in Great Britain. The Report has been published at 9d. net. and copies may be obtained direct from H.M. Stationery Office, or through any bookseller, by post 10d.

The Report discusses the description of services covered by distributors' margins, comments on the differences in costs as between one business and another, both proprietary and co-operative, and deals at some length with a consideration of what margins are reasonable under existing conditions in the trade, and the possibility of achieving more economical distribution.

One of the conclusions reached by the Committee is that important reductions in costs could be achieved by some rationalization of distributive services.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Cheshire: Mr. R. Garside, B.Sc.(Agric.), N.D.A., N.D.D., has been appointed Assistant Lecturer in Agriculture.

Gloucester: Mr. J. R. Stubbs, N.D.A., has been appointed Instructor in Agriculture, *vice* Mr. J. L. Congdon, N.D.A.

Hampshire: Mr. J. F. Willerton, N.D.P., has been appointed Assistant Instructor in Poultry-keeping, *vice* Mr. T. E. Whittle, N.D.P.

Oxfordshire: Miss K. Wright, N.D.D., has been appointed Assistant Instructress in Dairying and Poultry-keeping, *vice* Miss J. M. Brown, N.D.D.

Yorkshire: Mr. E. G. Hallsworth, B.Sc., has been appointed Assistant Lecturer in Agricultural Chemistry, *vice* Mr. C. E. Marshall, M.Sc., Ph.D.; Mr. R. Carrick, B.Sc., Ph.D., has been appointed Assistant Lecturer in Agricultural Zoology; Mr. T. E. Whittle, N.D.P., has been appointed an Instructor in Poultry Husbandry; Mr. W. S. English, N.D.H., has been appointed an Instructor in Horticulture, *vice* Mr. R. Duncan, N.D.H.; Mr. F. G. Smith, N.D.H., has been appointed an Instructor in Horticulture.

WALES

Brecon and Radnor: Miss E. Jones, N.D.D., Instructress in Dairying and Poultry-keeping, has resigned.

Carmarthen: Mr. E. O. James, B.Sc.(Agr.), has been appointed Instructor in Agriculture, *vice* Mr. A. D. Thomas, Vice-Principal of Pibwrlwyd Farm Institute, resigned.

Glamorgan: Mr. C. Kinsey, N.D.A., Technical Assistant, has been appointed Instructor in Agriculture, *vice* Mr. E. O. James, B.Sc.(Agr.) resigned.

FARM WORKERS' MINIMUM RATES OF WAGES

Farm Workers' Minimum Rates of Wages.—A meeting of the Agricultural Wages Board was held at Kings Buildings, Smith Square, London, S.W.1, on October 25, 1937.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders:—

Bedfordshire and Huntingdonshire. An Order fixing minimum and overtime rates of wages to come into force on October 31, 1937 (i.e., the day following that on which the previous rates expired) and to continue in operation until October 29, 1938. The minimum rates in the case of male workers of 21 years of age and over are 34s. (instead of 32s. 6d.) per week of 50 hours in summer, except in the weeks in which Easter Monday and Whit-Monday fall when the hours are 41; 48 hours in winter except in the weeks in which Christmas Day and December 27, 1937, fall when the hours are 39½, with overtime throughout the period at 10½d. per hour on weekdays (instead of 9½d.), 11½d. per hour on Whit-Monday, Easter Monday, and Christmas Day (instead of 10½d.) and 11½d. per hour on December 27, 1937, and 1s. 0½d. per hour on Sundays (instead of 11½d.). The minimum rates in the case of female workers of 18 years of age and over are 6½d. per hour (instead of 6¼d.) with overtime at 8d. per hour on weekdays (instead of 7¾d.), 9d. per hour on Whit-Monday, Easter Monday, and Christmas Day (instead of 8¾d.) and 9d. per hour on December 27, 1937, and 9½d. per hour on Sundays (instead of 9¼d.).

Cheshire. (1) An Order fixing minimum and overtime rates of wages for male workers and minimum rates for female workers to come into force on November 1, 1937 (i.e., the day following that on which the previous rates expired) and to continue in operation until October 31, 1938. The minimum rates in the case of male workers of 21 years of age and over are 35s. (instead of 34s.) per week of 54 hours, with overtime unchanged at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is unchanged at 6d. per hour for all time worked, provided that in the case of female workers engaged for milking, such workers shall receive not less than 6d. per "meal" (i.e., each occasion on which the worker visits her place of employment for the purpose of milking).

(2) An Order fixing a special rate of wage for male workers of 21 years of age and over for overtime employment on the Hay and Corn Harvests in 1938, such rate being 10d. per hour for all employment on harvest work on Sundays and in excess of 6½ hours on Saturdays and 9½ hours on any other day.

Lincolnshire (Holland). An Order fixing minimum and overtime rates of wages to come into force on October 31, 1937 (i.e., the day following that on which the previous rates expired) and to operate until further notice. The minimum rates in the case of male workers of 21 years of age and over are 36s. (unchanged) per week of 48 hours in winter, except in the week in which Christmas Day falls, when the hours are 39½, and 50 hours in summer except in the weeks in which Easter Monday, Whit-Monday and August Bank Holiday fall, when the hours are 41. In the case of horsemen, cattlemen and shepherds of 21 years of age and over inclusive weekly sums are fixed to cover all time worked in excess of the number of hours mentioned above, except employment which is to be treated as overtime employment. The overtime rates in the case of male workers of 21 years of age and over are unchanged at 1s. 1½d. per hour on Sundays and on Christmas Day, 9d. per hour on Easter

FARM WORKERS' MINIMUM RATES OF WAGES

Monday, Whit-Monday and August Bank Holiday and 10½d. per hour for all other overtime employment..

The minimum rate for female workers of 15 years of age and over is unchanged at 6d. per hour with overtime at 7d. per hour for all employment in excess of 5½ hours on Saturday or other agreed weekly short day, on Sundays and in excess of 8 hours on any other day.

Northamptonshire and Soke of Peterborough. An Order fixing minimum and overtime rates of wages to come into force on October 3, 1937 (i.e., the day following that on which the previous rates expired) and to continue in operation until October 29, 1938. The minimum rates in the case of male workers of 21 years of age and over are 34s. (instead of 32s. 6d.) per week of 48 hours in winter except in the week in which Christmas Day falls, when the hours are 39½ and 50 hours in summer, except in the weeks in which Easter Monday and Whit-Monday fall, when the hours are 41, with overtime unchanged at 10d. per hour on weekdays and 1s. per hour on Sundays, Christmas Day, Easter Monday and Whit-Monday. In the case of female workers of 18 years of age and over the minimum rate is unchanged at 6½d. per hour with overtime at 7½d. per hour on weekdays and 9d. per hour on Sundays, Christmas Day, Easter Monday and Whit-Monday.

Yorkshire (East Riding). (1) An Order fixing minimum and overtime rates of wages to come into force on November 24, 1937 (i.e., the day following that on which the previous rates expired) and to continue in operation until November 23, 1938. The minimum rate for all male workers of 21 years of age and over is 35s. 6d. (instead of 34s. 6d.) per week of 48 hours in winter, except in the week in which Christmas Day falls when the hours are 39½, and 52½ hours in summer except in the week in which Good Friday falls when the hours are 43, with, in addition, in the case of workers living in, not more than 12 hours per week on weekdays and three hours on Sunday spent on the care of and attention to stock. The overtime rates for male workers of 21 years of age and over are 11d. per hour on weekdays and 1s. 1d. per hour on Sundays, Good Friday and Christmas Day (instead of 10d. and 1s. respectively). The minimum rates of wages for female workers of 16 years of age and over remain unchanged at 6d. per hour with overtime at 9d. per hour.

(2) An Order fixing differential rates of wages for overtime employment on the Corn Harvest of 1938, such rates are in the case of all male workers of 21 years of age and over 1s. 3d. per hour, and in the case of female workers of 16 years of age and over, 11d. per hour (as in 1937).

Yorkshire (North Riding). An Order fixing minimum and overtime rates of wages to come into force on November 24, 1937 (i.e., the day following that on which the previous rates expired) and to continue in operation until November 23, 1938. The minimum rate in the case of male workers of 21 years of age and over (other than casual workers) is 35s. (instead of 34s.) per week of 50 hours in winter and 52½ hours in summer, except in the weeks in which Christmas Day and Good Friday fall when the hours are to be 41, and 43 respectively, with payment for employment in connexion with the care of and attendance upon animals, where the total hours exceed the number mentioned above, unchanged at 3d. per hour for those workers who are boarded and lodged by their employer, and 6d. per hour for those who are not so boarded and lodged. The overtime rates are 10d. per hour on weekdays and 1s. per hour on Sundays, Christmas Day and Good Friday (instead of 9d. on weekdays and 11d. on Sundays and Christmas Day). In the case of male casual workers of 18 years of age and over the minimum rate is unchanged

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at 7*d.* per hour for all time worked, a casual worker being deemed to be a worker of 18 years of age or over employed for not more than 14 days by the same employer between May 1 and October 1 inclusive. For female workers of 18 years of age and over the minimum rate is unchanged at 6*d.* per hour. For whole time female workers provision is made for payment at not less than 22*s.* per week of 36 hours in the weeks in which Christmas Day and Good Friday fall and 44 hours in any other week, with overtime at 9*d.* per hour.

Carmarthen. An Order fixing minimum and overtime rates of wages to come into force on November 15, 1937 (i.e., the day following that on which the previous rates expired) and to continue in operation until November 14, 1938. The minimum rates in the case of male workers of 21 years of age and over are 33*s.* (instead of 32*s.*) per week of 54 hours with overtime unchanged at 8½*d.* per hour. In the case of female workers of 18 years of age and over the rates are unchanged at 5*d.* per hour with overtime at 6*d.* per hour.

Glamorgan. An Order fixing minimum and overtime rates of wages for male workers employed wholly or mainly in forestry (i.e., employment in connexion with preparing land, planting and maintaining forestry areas and nursery work in connexion therewith) to come into force on November 2, 1937 (i.e., the day following that on which the previous rates expired) and to continue in operation until November 1, 1938. The minimum rates in the case of male workers of 21 years of age and over are 40*s.* (instead of 39*s.*) per week of 48 hours in winter and 52 hours in summer with overtime unchanged at 11*d.* per hour.

A further meeting of the Agricultural Wages Board was held on November 2, 1937, when the Board considered a notification from the Merioneth and Montgomery Agricultural Wages Committee of its decision to cancel the existing minimum and overtime rates of wages and to fix fresh rates in substitution therefor to come into force on November 8, 1937, and to continue in operation until April 30, 1938, and proceeded to make an Order. The minimum rate in the case of male workers of 21 years of age and over employed wholly or mainly as stockmen, teamsters, carters or shepherds is 35*s.* per week of 58 hours (instead of 34*s.* per week of 60 hours); and the minimum rate for other male workers of 21 years of age and over is 31*s.* per week of 52 hours (instead of 30*s.* per week of 54 hours) with overtime in each case unchanged at 9*d.* per hour. In the case of female workers of 18 years of age and over the minimum rate remains unchanged at 5*d.* per hour for all time worked.

Enforcement of Minimum Rates of Wages.—During the month ending November 12, 1937, legal proceedings were taken against two employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow:—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers involved
Shropshire Staffordshire ..	Pontesbury Wolverhampton	£ s. d. 5 0 0	£ s. d. 0 6 0	£ s. d. 32 10 0	1
		1 0 0	—	14 15 0	1
		£6 0 0	0 6 0	47 5 0	2

FOOT-AND-MOUTH DISEASE

Foot-and-Mouth Disease.—No further outbreaks of foot-and-mouth disease were confirmed in the Hastings (Sussex) and Scamblesby (Lincolnshire) Infected Areas, and these Areas were, in consequence, freed from restrictions on October 26, in each case. The position on Nov. 23 is set out below.

An outbreak of the disease at Thurning, Norfolk, on October 16 has been followed by 67 further outbreaks in the eastern and south-eastern counties of England, necessitating the declaration of ten separate Foot-and-Mouth Disease Infected Areas, as follows :—

No. 1. *Norfolk and East Suffolk.*—Infected Area surrounding the Infected Places at Thurning, Salhouse and Reydon, Suffolk (26 cases have been confirmed altogether in this area).

No. 2. *Surrey.*—Approximately 15 miles round the Infected Place at Worplesden, Guildford.

No. 3. *Norfolk, Suffolk, Cambridge and Essex.*—Approximately 15 miles round the Infected Places at Feltwell, Norfolk; Stowmarket and Coney Weston, Suffolk; and Ramsey, Essex.

No. 4. *Sussex* Infected Area.—Approximately 15 miles round the Infected Places at Beddingham and Herstmonceux.

No. 5. *Kent.*—An Infected Area of approximately 15 miles round the Infected Places at Godmersham and Frittenden. (13 cases of disease have occurred in this area.)

No. 6. *Essex.*—A semi-circle of 15 miles radius round the Infected Place at West Tilbury.

No. 7. *Lincoln (Lindsey).*—Approximately 15 miles round the Infected Place at Timby.

No. 8. *Huntingdon.*—Approximately 15 miles round the Infected Place at Elton, Huntingdonshire. The Infected Area comprises parts of Huntingdon, Soke of Peterborough, Isle of Ely, Lincoln (Holland), Rutland and Northampton.

No. 9. *Essex, Hertford and Middlesex.*—Approximately 15 miles round the Infected Place at Nazeing, Essex.

No. 10. *West Sussex.*—Approximately 15 miles round the Infected Place at Petworth.

In view of the serious situation arising out of so many outbreaks of the disease, the Ministry decided on November 9 to issue a "Standstill" Order applying to some of the eastern and south-eastern counties of England. The Order prohibits the movement of animals out of the controlled area, except to places in a Foot-and-Mouth Disease Infected Area contiguous to the controlled area, but permits the movement of animals into the area from a "free" area or within the controlled area or from the controlled area to a contiguous Foot-and-Mouth Disease Infected Area, provided that in all cases of movement licences authorizing such are obtained from the appropriate Local Authority. With the exception of markets and sales of animals intended for immediate slaughter, and of farm sales, all markets, fairs, sales and exhibitions of animals in the controlled area are prohibited. The controlled area comprises: The Soke of Peterborough, the counties of Lincoln (parts of Lindsey, Kesteven and Holland), Huntingdon, Cambridge, Isle of Ely, Norfolk, East and West Suffolk, Essex, Bedford, Hertford, Middlesex, London, Surrey, Kent and East and West Sussex, including any county or other boroughs geographically situated therein but excluding any part of such counties and boroughs which are for the time being comprised in any Foot-and-Mouth Disease Infected Area for the purposes of the Foot-and-Mouth Disease (Infected Areas Restrictions) Order of 1925.

WIRELESS TALKS, DECEMBER, 1937

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National :			
Dec. 1	6.20	Mr. W. S. Mansfield	Poultry.
" 8	6.20	" "	The Smithfield Show.
" 15	6.20	" "	Odd Jobs.
" 22	6.20	" "	Pigs
" 29	6.20	" "	Land Drainage.
North :			
Dec. 10	6.40	Mr. J J Green and Mr. R. L. Muirhead (a farmer from West- houghton)	Land Fertility in Lancashire.
Midland :			
Dec. 2	7 25	Mr. W. B. Thompson	For Midland Farmers.
" 16	6.40	Mr. W. A. Stewart	Christmas Beef, including some account of the Smith- field Show.
West :			
Dec. 2	6.45	—	For Young Farmers.
" 9	8 30	—	For Western Farmers in par- ticular.
" 12	7.10	May Elliot Hobbs	Some Farming Families
" 16	6 25	—	For Young Farmers.
" 23	8 15	—	For Western Farmers in par- ticular.
Welsh :			
Dec. 3	7 30	Members of Young Far- mers' Clubs, from North and South Wales	Did Cardiganshire Make a Mistake to Replace Welsh Black Cattle by the Short- horns ? (In Welsh)
" 6	6 45	Miss Nellie Davies	Things that Interest a Far- mer's Daughter.
" 17	8 0	Mr Thomas Lewis and Mr. Evan Rees	For Welsh Farmers : A dis- cussion on the History of the Production, Treatment and Marketing of Butter during the Past 60 Years.
Scottish :			
Dec. 2	6.30	Miss Katherine Boyd	Training at Craibstone.
" 9	7 30	Mr. William K. Wright	For Scottish Farmers.
" 16	6.20	A discussion between Lord Rowallan and Mr. Joseph F Duncan	Cattle Breeding in the High- lands.
" 23	—	Mr. A. D. Buchanan Smith	For Scottish Farmers.
" 30	6 10	Mr. John R. Allan	Hogmanay Memories.
Northern Ireland :			
Dec. 3	7.30	Mr. A. E. Muskett	For Ulster Farmers : Control of Crop Diseases.
" 10	6.0	Mr. Peter Fitzpatrick	Farmers Work and Worry.
" 17	6.40	—	Discussion : Is Agricultural Education a Failure ?
" 20	7.30	An official of the Minis- try of Agriculture.	For Ulster Farmers.

NOTICES OF BOOKS

Milk Ration Indicator. Devised by E. David, B.Sc. (Hughes & Son, The Griffin Press, Pontypool, 1937. Price 5s. post free.)

Mr. David has succeeded in evolving a device of value as a simple and reliable guide for the easy determination of the proportions in which various foods for dairy cattle should be mixed together to produce a balanced ration, and the quantities of the compounded mixture to be used for each gallon of milk produced.

The device consists of a fixed buff disc on which is marked the carbohydrate foods, a revolving grey disc showing the "protein" foods, and a winged blue disc showing foods from the "bran" and "balanced" group of foods; these are superimposed on a stiff piece of cardboard (6 in. \times 10 in.), on both sides of which is printed information concerning the use of the indicator, and other useful notes on the feeding of cows.

The manner in which the desired foods should be mixed together is ascertained by simple manipulation of the revolving discs. The device is ingenious and simple to use.

Weed Plates, with Explanations. By Prof. Dr. E. Korsmo. Series I, Plates i-xxx, and 79-page brochure (1934); Series II, Plates xxxi-ix, and 92-page brochure (1935). Leipzig C.I.: Koehler & Volckmar A.-G. & Co. Prices: Paper sheet form unmounted, 22 RM. per set; on leather paper with cloth edge and eyelets for hanging, 38 RM. per set; each with descriptive text-book in English, French, German or Norwegian, as desired.)

It is not unusual for inquiries to be made as to where good illustrations of weeds can be obtained, and one can safely recommend this finely-prepared and excellently-produced series of large coloured plates or wall charts by such a widely-recognized authority as Dr. Korsmo, whose work on weed control must be regarded as second to none. The illustrations are in three series of 30 plates each, and include a total of 136 species of weeds, not all of which, however, are of interest to farmers in Great Britain, though most of them are. The first two series have already been published, and the set is to be completed by the third series, which will be ready within the next few weeks. These plates illustrate the seeds, seedlings and mature plants, with sections of flowers, etc., and names of plants are given in Latin, English, German, French and Norwegian. The explanatory brochures give a general account of each weed illustrated—names in several languages, distribution, description, etc., with references to the relative plates, but do not deal with control measures. The publishers are Norsk Hydro-Elektrisk Kvaelfstofaktieselskab, Oslo, and the work is obtainable from Koehler and Volckmar A.-G. & Co., Leipzig C.I. It may be added that anyone interested may see the first two series of these plates in the Ministry's Library at 10 Whitehall Place, London, S.W.1; the third series will be available later.

The Hill Lands of Britain. By Professor R. G. Stapledon. Pp. 138 & 5 Maps. (London: Faber & Faber, Ltd. Price 6s.)

The work of Professor Stapledon needs no introduction to readers of this *Journal*. His epoch-making work, *The Land: Now and To-morrow*, has secured an international reputation, and that very justly. It has, indeed, been said that Professor Stapledon's proposals for the reclamation of our hill lands is the most important contribution to agricultural research that has been made in the present century.

NOTICES OF BOOKS

In dealing with his subject, Professor Stapledon does not confine himself entirely to the agricultural value of his suggestions. He considers their social implications, both from the point of view of rural settlement and amenity value to the urban population.

The present small book should be widely read by townsmen, who will find it illuminating, perhaps more illuminating than the earlier books, because it is a simple, brief treatise and not burdened with a large measure of technicalities.

Professor Stapledon is an idealist, but he combines with his idealism a very considerable measure of the qualities of a practical man. In the past, too many idealists have promulgated policies without showing how they could be carried out. Usually, these idealists have not taken sufficient care in considering the administrative problems involved; when they come before practical men of affairs and experience, these administrative problems are found to be insoluble. Professor Stapledon does not fall into this pitfall, but shows how his wishes could be fulfilled and how readily his ideas could be translated into reality.

Life on an English Manor: A Study of Peasant Conditions, 1150-1400.

By H. S. Bennett. Pp. xviii + 364. (Cambridge University Press. 1937. Price 16s.)

The pre-Raphaelites created about the circumstances of mediæval life an atmosphere of romance that still surrounds it for many people who are not specialist historians, but to anyone acquainted with Dr. Coulton's *Mediæval Village* and other works, the realistic picture presented by H. S. Bennett will come as less of a shock. Here is information, carefully and meticulously culled from all sorts of disparate sources, and equally carefully moulded into completeness. The conditions of life of the ordinary man during these two-and-a-half centuries have been made clear.

Subjects such as housing, clothing and diet on a quantitative basis are discussed, and a picture is drawn of the kind of house that was usual—details of its size, the number of rooms it contained and the sparse furniture that was in them, being provided. Some indication is even provided of the number of garments that each person wore and what they may be supposed to have had in reserve. The supply of food, its components, the meals it went to make up, are stated, and though, in some eyes, it is possible that the estimate of the quantity of cereals consumed *per capita* may be unduly high, it would be unfortunate to make a criticism of the conclusions arrived at, unless a careful examination of the data presented, and any more that could be found, had been made.

Again, the ordinary man is shown in his social relations with his neighbours, in his legal status as a member of the community, and in relation to the church and to his lords and masters; the methods of his control are not omitted. His daily round of work and the methods by which he gained his living enter into the picture. The few pleasures that came his way form a chapter to themselves.

This is the kind of history we want, and the book should be widely read, not only by those who are studying the development of our society, but also by the ordinary citizen who should be fascinated by the complete strangeness of the life led in our land so few short centuries ago.

The Cycle of Weathering. By B. B. Polynov, D.Sc. Translated from the Russian by A. Muir. Pp. xii + 220. (London: Thomas Murby & Co. 1937. 10s. 6d.)

Russian investigators have obtained a well-merited reputation in the field of soil studies: it is to the Russian school that we owe the impetus that has led to the recognition of these studies as a branch of pure science.

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Professor Polynov, the author of this work, occupies a leading position among soil investigators, and his views command special attention. Dr. Muir's translation is to be welcomed, not only because it renders accessible to English readers the latest ideas of a leader in pedology, but also because Dr. Muir has worked under Professor Polynov and is therefore in a position to give an authoritative version of his views.

The present work is concerned specially with the weathering processes antecedent to the actual processes of soil development. It is therefore of interest to geologists as well as to pedologists, since it deals with some of the fundamental problems of dynamical geology. Much of the information is already familiar to students of soils. The merit of the work lies rather in the arrangement and synthesis of existing knowledge into an ordered philosophy of the weathering cycle. The author distinguishes between juvenile and vadose forms of the different elements, the former term being applied to materials occurring in the deeper zones of the earth's crust of weathering. The cycle is traced for the most important elements.

Perhaps the most important section of the book is that in which Professor Polynov distinguishes the successive stages of weathering, from the detrital, through the calcareous and siallitic, to the final phase in which only sesquioxides remain as residual products. Subsidiary weathering cycles are distinguished in which the parent materials are the products of previous weathering. To those who have known the strong tendencies of the Russian school towards the climatological standpoint in pedology, it will be somewhat surprising to learn that climate is significant chiefly as determining the rate of weathering, and that theoretically all stages of weathering can occur in any climate.

The book is written in an easy and lucid style, from which it is evident that the translator is sufficiently master of the subject to avoid the inconveniences of literal translation.

**Taschenbuch der Gräser, Ihre Erkennung und Bestimmung
Bewertung und Verwendung.** By Ernst Klapp. Pp. 199. (Berlin :
Paul Parey. 1937. Price Rm.5.80.)

Professor Klapp, of the University of Bonn, is well known for his researches and publications on herbage plants and grassland problems. In this volume he has compressed into a small space a considerable mass of up-to-date information about European grasses, and produced a handbook that can conveniently be carried in the field by the student or used by the research worker to refresh his memory on numerous points.

The first portion of the book (pp. 9-77) deals with the features by which the species may be recognized either when not in flower or at the flowering stage, and identification keys are given for this purpose. On pp. 78-130 the species are illustrated by original pen drawings by the author (Plates 9-45) and also by photographs in Plates 46-61. Chapter IX deals with the distribution, habitats and agricultural uses of ninety-five grasses. The rest of the book consists largely of tables giving information on the habits, flowering periods and duration of grasses and their use in seeds mixtures. References to literature follow.

Grasses are rather difficult to photograph and the photographs in this little volume are not very satisfactory : they suffer from the compression associated with a handbook ; they are too small, and often too many are crowded on a single plate. A more serious matter is that neither the pen drawings nor the photographs follow any definite scale of reduction or enlargement, nor is the comparative natural size of the inflorescence indicated. Illustrations of the seeds of grasses, drawn to scale, might also have been given with advantage.

Readers must, of course, bear in mind that the evaluation of the species

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and their uses given in Chapter IX onwards are those ascertained under Continental conditions and will not always apply to British conditions.

Subject to such considerations the book may be recommended to those for whom it is intended.

Leguminous Forage Plants. By D. H. Robinson, Ph.D., B.Sc., N.D.A.
Pp. vi + 119, and 35 Figs. (London: Edward Arnold & Co. 1937.
Price 6s.)

Accurate botanical descriptions of leguminous forage plants with up-to-date information about their agricultural uses were not to be found in any convenient English volume. Dr. Robinson, who is head of the Biology Department at Harper Adams Agricultural College, has written this little book to fill the blank.

After describing the general botanical characteristics of these plants, the true Clovers (*Trifolium*) are dealt with in Chapters II and III, and the Medicks (*Medicago*) in Chapter IV. The other leguminous crop plants follow in the remaining chapters.

Under the heading of each species a description is given of its general characters, seed and seedling, and a short account of its history in cultivation and general uses. Information is also supplied on seed production and the chemical composition of the plant either in the form of a green crop or as hay. The cultivated types of each species are described and distinct strains or forms of these (if any) are mentioned. Some of the less important species have been deliberately described in some detail, and the soya bean is included. Although not a leguminous plant, Burnet is described on account of its common association as an impurity with sainfoin.

A few minor points should receive attention in future editions. In treating the Field Pea, the varieties have not been sufficiently distinguished or described. There are considerable botanical and agricultural differences between the Maple type and the Dun type which are not mentioned. In the illustration of the Field Pea seed in Fig. 35 it is not made clear whether the Maple or Dun type is shown, nor is it clear which species of Burnet is shown in Fig. 22. The common name Hop Clover is best reserved for *T. procumbens* as on p. 40, and not used as an alternative for Black Medick as on p. 56.

The volume is well printed and the illustrations, drawn by the author from living specimens, are well done and give a good impression of the habit of growth and foliage aspect of the plants. Particularly useful features are the figures of the seedlings. The text descriptions are clear and accurate, and written as far as possible without the use of technical terms; a short glossary of the latter is given at the end. The book can be heartily recommended as a safe guide to agricultural students and to all interested in these plants.

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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The Minister's Address to The Agricultural Education Association

The Agricultural Education Association held its annual luncheon at the Euston Hotel on December 8, 1937. The Right Hon. W. S. Morrison, M.P., Minister of Agriculture, who is this year President of the Association, was in the chair. The following are extracts from his reply to the toast of "The President" :—

" I am very glad indeed to become the President of this Association. We are realizing that in this industry of agriculture the application of practical intelligence to its problems is probably the most important thing we have to accomplish. The research which has taken place in recent years has been most fruitful of results, but the difficulty has always been to bring the laboratory into contact with the farmer.

" The more the research worker and the education officer can mix together and share their problems the better will be the agricultural education in our country. For that reason I welcome this association, which not only brings together by its conferences and gatherings education officers all over the country, but provides that intimate link between research and education which enables, ultimately, the fruits of research to reach the farm.

" Mr. Ramsbotham* has spoken of the problems of agricultural education. We at the Ministry are well aware of the structure which has been built up, and which will, I hope, be capable of further development in the future; but I do agree to the necessity of starting at the bottom with elementary education and seeing that it is suitable for the great vocation of agriculture.

* The Minister of Pensions also spoke at the luncheon.

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"No one can view without misgiving the fact that for the past forty years there has been a steady drift to the towns. I believe housing is a very important contributory factor. The Minister of Health is putting forward proposals which I hope will go some way towards giving the agricultural worker what he must have if he is to remain in the country—a home where he can get married.

"Behind all the causes, however, and going to the root of the matter, is a factor which, I believe, can only be reached by education. We commonly talk of 'agricultural education' as if its only function and purpose were confined to passing on the results of research to farmers. There is something deeper and more profound in the duties which it can perform and the benefits which it can confer on the countryside.

"I am sometimes a little unhappy at an expression we use, namely, 'giving education a rural bias.' It sounds as if we were weighting the scales of education for some commercial or industrial purpose connected with rural industry. The truth is rather the reverse. Education has quite unconsciously been biased for a generation in an urban direction, and what we ought to seek in rural education is to restore the balance to make sure that we are giving a balanced outlook on life to the children who are entrusted to us."

Malting Barley

The Malting Barley Conference organized at Rothamsted with the help of the Institute of Brewing may almost now be regarded as an annual event, for the fourth meeting, held at Harpenden on November 24, was as well attended as ever, and the proceedings were followed with the usual interest. U. Roland Burke, Esq., President of the Royal Agricultural Society of England, was in the chair. The main object of these meetings is to enable growers to examine a large number of samples of home-grown barley that have been graded by the Valuation Committee of the Institute of Brewing. The samples cover the whole range of the trade, from the best down to samples too poor to be classed as malting material at all. Grading is by hand valuation, but quantitative tests are made at Rothamsted for dry matter, nitrogen content, 1000-corn weight and colour. Seven grades are distinguished. Grades I, II and III are pale-

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ale barleys, IV, V and VI are suitable for mild ale, while VII is unfit for malting. The distribution of grades in the various regions was as follows:—

Grade	Nor-folk	Suf-folk	Essex	Lincs and Yorks	East Mids	Kent	West	South	Total	Per cent.
I ..	0	4	3	0	2	2	1	1	13	6
II ..	3	12	4	0	4	7	3	3	36	16
III ..	6	6	7	5	6	4	4	13	51	22
IV .	12	7	5	9	2	1	18	16	70	30
V ..	10	6	1	9	4	0	7	9	46	20
VI ..	4	0	1	3	1	0	1	1	11	5
VII .	0	0	1	0	1	0	1	1	4	2
TOTAL .	35	35	22	26	20	14	35	44	231	—
MEAN GRADE	4.2	2.8	3.2	4.4	3.5	2.3	4.0	3.8	—	—

The agricultural history of these barleys is known, and one of the aims of the Conference is to trace out relationships between manner of cultivation and grading results. For this reason it is most important that growers shall not come to regard these meetings either as Grain Shows or as County Competitions. Poor samples are wanted as well as good ones in order to determine the factors at work. The need for securing more representative samples was stressed by several speakers, and this will no doubt be arranged for in future.

Quality, while vital to the maltster, is by no means the only consideration for farmers, who are primarily concerned with value per acre. Yields are therefore recorded whenever obtainable. It is hoped that as data accumulate they may throw some light on the relationship between yield and quality. Are they compatible or antagonistic? It is true that the success of the modern varieties lies in the fact that, compared with the older sorts, they show high yield associated with high quality, but within these varieties there is some evidence that quality is sometimes obtained at the expense of yield. Thus, autumn-sown barleys grade higher but usually yield less than spring-sown. The same is true of barley after corn as compared with barley after sheep.

It is interesting to observe that the technical experts were willing to admit that there was still room for precision in respect of the prevailing methods of valuation, in the speci-

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cation of brewers' requirements, and in the guidance of plant breeders engaged in producing new varieties. The Institute of Brewing itself is doing a great deal in this connexion, as was pointed out by Dr. Bishop in his remarks on the work at Birmingham.

A feature of the Conference that is always listened to with great interest is Mr. H. M. Lancaster's account of the year's barleys and his remarks on valuation. In his view, the span in price between the best and the worst malting samples is not a fair measure of their respective values as malting material, the tendency being to over-value the best samples and under-value the inferior ones. Actually this span in price is much less in this season of scanty yields than usual, and Mr. Lancaster showed that, owing to the brisk and almost anxious demand for malting barley, the farmer's return per acre was likely to be considerably more in 1937 than two years ago. Several speakers dealt with the question of low yield. Mr. Lake, ex-President of the Brewers' Society, was anxious about supplies for the months ahead and urged farmers to maintain regular deliveries. The poor crop was attributed to Gout Fly by Dr. Beaven, to poor seed bed conditions by others, and to soil exhaustion following the very heavy crop of sugar beet of 1936 by Mr. Rayns. Possibly the protracted leaching in the exceptionally wet winter and spring may have been a contributory cause.

Growers using combine harvesters received some encouragement. A preliminary test conducted by the Institute of Brewing and reported by Mr. Lancaster showed that in 1936 barley harvested by the combine and dried on the farm gave samples rather superior in quality to those harvested from the same set of fields in the ordinary way. A number of very good barleys on view at the Conference were harvested by combine. Mr. W. D. Hollis, of the Leckford Estates, secured some particularly heavy crops of excellent quality by combine, and users agreed that the season was ideal for combine work.

Examination of the records showed that combine harvesting was frequently associated with the use of the newer high-analysis compound fertilizers, and in several instances these granular products were being drilled with the seed in one operation. This practice was favourably commented on and appears to have advantages on the grounds of economy in labour, in effect on yield, and even on the boldness of the

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samples. This development will be watched with interest and deserves quantitative study.

A considerable divergence of views was expressed on matters of soil cultivation. For example, one grower had obtained good results this year by "smearing his barley in" early in spring. Another had forced himself to wait till he could draw his foot through the full depth of tilth without dirtying his boots. The feeling of the meeting seemed to incline more to the second view than to the first. None the less, examination of the questionnaires revealed instances in which the grower who appeared to have done everything wrong as judged by accepted standards finally attained a good quality sample.

Local Destructive Insects and Pests Orders

Under the Destructive Insects and Pests Acts, 1877 to 1927, the Minister of Agriculture and Fisheries is empowered, *inter alia*, to make Orders for the purpose of preventing the introduction and spreading in Great Britain of insects, fungi and pests destructive to agricultural or horticultural crops. Orders have been made (e.g., the Importation of Plants Orders and the Sale of Diseased Plants Orders), which, in pursuance of these Acts, are designed to prevent the introduction and spread of insects and pests throughout the country.

Certain insects and pests, however, are of local, rather than national importance, in the sense that, while neglect to deal with them on one holding may endanger neighbouring holdings, the risk of long-distance spread of infection is small. The control of such insects and pests is therefore regarded primarily as a local problem and it is the Ministry's policy to encourage Local Authorities to take steps with the co-operation of growers to secure the "cleaning-up" of infested orchards and crops.

The main purpose of Local Orders under the Destructive Insects and Pests Acts is to give power to Local Authorities to use compulsion as a last recourse to secure treatment in cases where a grower's plantation constitutes a centre from which the plantations of neighbouring growers are likely to become infested, and where the grower concerned fails to adopt the advice tendered to him as to methods of control of pests. Such local Orders are only issued as the result of requests from, or with the concurrence of, associations representative of growers in the areas affected. Local Orders are now in force dealing

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with the control of (a) fruit tree pests, (b) narcissus pests, and (c) cabbage aphids.

(a) **Fruit Tree Pests.** The usual form of Order provides that, on a complaint being made by a grower that there is a likelihood of the spread of certain pests from a neighbouring plantation to his own, an officer appointed by the Local Authority may inspect the plantation of which complaint is made, and, if the complaint is found to be justified, the Local Authority may, by Notice served on the Occupier, order the treatment or destruction of the infective material. In practice, it is seldom necessary for the Local Authority to serve such a notice, treatment usually being undertaken voluntarily by the grower concerned. Fruit Tree Pests Orders are now in operation in the following Counties:—Berkshire, Buckinghamshire, Cambridgeshire and the Isle of Ely, Essex, Hampshire, Huntingdonshire, Kent, the Holland division of Lincolnshire, Middlesex, Norfolk, East and West Suffolk, and East and West Sussex.

Reports received by the Ministry indicate that these orders have done much to improve the general standard of orchard hygiene in these areas, and that they are appreciated by progressive growers.

The Apple Capsid (Essex) Orders of 1932 and 1934 are different in character from the other local Orders relating to fruit tree pests. They were made at the request of the local Authority at a time when it was believed that the Apple Capsid did not exist in Essex; soon after the 1932 Order had been made, however, the pest was found in two parishes. These Orders require any person other than the private grower as defined in the Orders, who receives any apple tree or gooseberry or currant bushes for planting, or any scions, cuttings or other woody parts of apple trees or gooseberry or currant bushes for propagation or for sale for propagation, to notify the fact to the Local Authority. Officers appointed by the Local Authority are empowered to enter any premises in the district and examine any apple trees or gooseberry or currant bushes, and the Local Authority, on being satisfied that the Apple Capsid exists on any such trees and bushes, may require the occupier to carry out any prescribed treatment.

In 1937 notices were served by the Local Authority on 45 occupiers, requiring them to treat their trees or bushes in the prescribed manner.

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(b) **Narcissus Pests.** (i) *Bulb Diseases (Isles of Scilly) Orders of 1923 and 1924.* These Orders, which were made at the request of the bulb growers of the Scilly Isles with the object of preventing the introduction of eelworm and other pests or diseases of bulbs, prohibit the entry into the Islands of Daffodil and Narcissus bulbs, unless before shipment they have been officially certified as healthy or to have been subjected to the hot-water treatment; alternatively that they are licensed to be sent to the Bulb Treating Station at St. Mary's for hot-water treatment. The orders also contain certain provisions with regard to the destruction or treatment of diseased Daffodil or Narcissus bulbs in the Scilly Isles.

During 1937, 7 licences were issued by the Ministry authorizing the movement of Daffodil and Narcissus bulbs from England to the Bulb Treating Station at St. Mary's, and 9 consignments were examined by Inspectors of the Ministry before shipment to the Scilly Isles and certified as healthy.

(ii) *Narcissus Pests (Cornwall) Order of 1935.* This Order was made at the request of the Cornwall County Council and came into operation on February 1, 1936. Under the Order, officers appointed by the Local Authorities of the County of Cornwall and the Boroughs of Penzance and Truro are empowered to examine Narcissus plants or bulbs in their respective areas and to take action to prevent the spread of infestation by Narcissus Flies or eelworm. Such action may be taken without awaiting a complaint from a grower.

(iii) *Narcissus Pests (Lincolnshire, Holland) Order of 1937.* This Order was made at the request of the County Council for Lincolnshire (Holland) and came into operation on April 1, 1937. Under the Order, officers appointed by the Local Authorities of the County of Lincoln (Parts of Holland) and the Borough of Boston are given powers similar to those provided under the Cornwall Order, mentioned above, to prevent the spread of infestation by Narcissus Flies, eelworm or Bulb Scale Mite.

(The Counties of Lincoln (Holland) and Cornwall include about 60 per cent. of the total acreage in England and Wales under Daffodils and Narcissus.)

(c) **Cabbage Aphis.** Growers of brussels sprouts in the important vegetable-growing area in Bedfordshire and adjoining counties have been very much troubled in recent years by the spread of infestation by the Cabbage Aphis. The life

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history of this pest has been investigated by workers at Cambridge University in co-operation with officers of the Bedfordshire County Council and a suitable method of treatment has been found.

It was decided that, in view of the local incidence of Cabbage Aphis, control could properly be effected by Orders similar to those made for the control of Fruit Tree Pests and at the request of the County Councils concerned, the *Cabbage Aphis (Bedfordshire, Cambridgeshire and Huntingdonshire) Order of 1936* was made on February 21, 1936, and came into operation on March 1, 1936.

The Order enables officers appointed by the Local Authorities concerned to enter any premises situate within the area defined in the Order, between February 15 and June 30 in any year, and examine any brussels sprouts, cabbage, kale, turnips or other Brassica crop. If any such crop is found to be substantially infested with the Cabbage Aphis, the Local Authority may serve a Notice on the Occupier of the premises requiring him to treat the crop in a prescribed manner. The Ministry is informed that, in 1937, Notices were served on three occupiers in Huntingdonshire requiring the treatment of affected crops. In other instances, growers voluntarily carried out measures suggested by the appointed officers for preventing the spread of the pest.

The Cabbage Aphis (Hertfordshire) Order of 1937, made on January 4, 1937, and operative from February 15, 1937, applied similar provisions to the adjacent area in North Hertfordshire in which brussels sprouts are extensively grown. During 1937, 23 Notices were served under this Order requiring the treatment of affected Brassica crops.

Articles on Farm Machinery

The increased use of mechanical methods on the farm has frequently been reflected in this JOURNAL by occasional specialist articles, but it is believed that many readers would welcome a more regular contribution. Arrangements have therefore been made for Mr. S. J. Wright, M.A., Director of the Institute for Research in Agricultural Engineering, Oxford, to deal with this subject in a series of articles covering briefly many matters of importance. These articles will for the present appear in alternate months, and the first of them will be found on pages 987-991 of this issue.

AGRICULTURAL POLICY

Minister's Statement to Deputations from the National Farmers' Union and the Milk Marketing Board

The National Farmers' Union

On December 7 the Minister of Agriculture and Fisheries received a deputation from the National Farmers' Union on the subject of agricultural policy, with special reference to the White Paper on Milk Policy, issued in July last (Cmd. 5533).

In the course of a statement which he made on behalf of the deputation *Sir Reginald Dorman-Smith*, after referring to the manner in which past experience had shown the need for framing trade policy with due regard to the interests of home agricultural production and the importance of domestic trade to those engaged in productive industry, said that the confidence of farmers had been shaken by what had happened to the applications submitted to the Import Duties Advisory Committee in regard to meat and livestock, milk products, and eggs and poultry; by the presumed abandonment of the levy subsidy policy; by the absence from the Government's recent statements on milk and bacon pigs of any reference to control of competing imports; by the increase in production costs; and by some of the Trade Agreements, negotiated and in prospect. The National Farmers' Union had never pinned its faith to one method of protecting agricultural interests to the exclusion of all others, nor had the Union asked that assistance should be given when price levels were satisfactory, but they did ask that means should be available to avert a repetition of those slumps which in past years had had such catastrophic results.

Sir Reginald pointed out that there were other measures which it was hoped might soon engage the attention of H.M. Government, such as statutory provision to enable the Agricultural Mortgage Corporation to cater more adequately for the credit requirements of the industry, both long-term and short-term, and action to deal with the effect of the Death Duties in contributing to the creation of a shortage of the capital required for the equipment of the land. Both these

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matters had a direct bearing upon the Government's present programme, inasmuch as its development must inevitably be retarded if credit facilities were inadequate and if landowners lacked the resources wherewith to supply necessary equipment on their estates. Their bearing was particularly manifest in the case of milk policy. The White Paper on that subject had undoubtedly created serious anxiety amongst dairy farmers throughout England and Wales by reason, mainly, of (1) the absence of any reference to control of imports, (2) the inadequate "insurance" basis for manufacturing milk prices, and (3) the steep "tapering" of quality premiums.

The Minister in reply associated himself with the emphasis laid by the Union on the interdependence of agriculture and industry and the need for mutual understanding of each other's requirements. As the Prime Minister had said at Edinburgh recently, the prosperity of one was essential to the prosperity of the other. Although the vast bulk of our wealth was derived from our industrial and commercial activities, there had been in recent years a growing appreciation of the vital importance of agriculture in our national economy.

The Government's broad objective, as had often been stated, was to ensure that maximum supplies of foodstuffs should be available within the purchasing power of the consumer, consistent with reasonable remuneration for the efficient producer. As the National Farmers' Union recognized, there was no single method by which that objective could be secured. Conditions change from time to time; plans must, therefore, be capable of adjustment. Where tariffs were suitable they had been employed, but seeing that the protective tariff that was generally applicable to manufacturing industry was not suitable for application to many branches of agriculture, the Government had adopted a variety of other methods of assistance. Use had been made of subsidies and regulation of imports, together with various measures intended to lower costs of production and to increase efficiency both in production and marketing. In fact, the range and variety of the measures that had been taken, or were proposed, to improve the position of agriculture constituted, when viewed as a whole, a programme of action that might fairly be described as comprehensive, and provided both an earnest of future intention and an indication of the importance which the Government attached to the

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agricultural industry and of their determination to promote its welfare.

It was true that Ministers had on occasion contemplated that some form of levy subsidy might afford the best means, in the conditions then obtaining, of assisting agricultural industries, including those of meat and milk production, but the conditions were exceptional. For one thing, prices were abnormally low. For example, in July, 1935, the average price per cwt. of imported butter was 96s. 6d., and of imported cheese 54s. 4d.; in the previous year prices had been even lower; to-day prices were appreciably higher.

No final decision to put into operation the system of levy subsidy had been taken by Ministers in recent years, and when it became necessary to formulate legislation providing for assistance to the cattle industry, the Government had decided that it would be preferable and more advantageous to producers to adopt the system of direct Exchequer assistance, not depending on the proceeds of duties, rather than an earmarked levy.

So in the case of the milk industry, the Government had reached the conclusion that in the changed circumstances and under existing conditions the levy subsidy was not a suitable means of giving assistance. Both in the general public interest and in the real interest of the farmers, the Government had preferred the method of direct Exchequer assistance coupled with a price insurance plan as announced in the White Paper.

It had been suggested that assistance in these forms had not the same degree of permanence as a customs duty. But it should be remembered that when the policy of protective tariffs was adopted, the Government made it clear that it was intended to use the tariff system for bargaining purposes with other countries. An import duty might, therefore, be withdrawn at short notice for the purpose of a trade agreement. The withdrawal of Exchequer subsidies and guarantees, on the other hand, provided for agriculture under statute, would require further legislation.

As regards the proposed Exchequer subsidies for quality milks, the Government recognized that it was difficult at this stage to forecast accurately what would be the effect of the quality premiums and Exchequer contributions proposed in the White Paper. When the legislation to give effect to these proposals was introduced, the Government would

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provide that a review should be undertaken by the proposed Milk Commission during the third year of the Scheme, and that the Commission might also, if they considered it expedient, initiate such a review during the second year, i.e., before any reduction in the rate of Exchequer contribution took effect. In either case the purpose of the review would be to permit an assessment to be made of the extent and method of application of the Exchequer assistance to be thereafter made available, in the light of the progress made in the production of clean and pure milk and of the needs of the industry.

Referring to the proposal set out in the White Paper to safeguard the industry by means of a price insurance plan against the effect of any serious fall in the prices of butter and cheese, the Minister said that this was an important element in the security which it was the Government's aim to afford to the milk industry and it was desirable that the plan should take some account of the seasonal variation in the quantities of milk available and in the costs of production. Accordingly, and having regard to the prevailing level of prices, the Government's proposals under this heading, as they would be presented to Parliament in due course, would provide that the price levels at which the Exchequer payment would begin would be an average of 112s. in summer and 120s. in winter per cwt. of butter and of 62s. 6d. in summer and 67s. 6d. in winter per cwt. of cheese instead of 100s. for butter and 56s. for cheese all the year round, as originally proposed. It was also proposed to fix the standard gallonages of milk manufactured into butter and cheese in Great Britain in respect of which the guarantee would operate at 125 million gallons per annum in each case. This figure approximated to the actual figures in 1935-36 and was in excess of the actual figures for 1936-37. Furthermore the forthcoming legislation would provide for an independent review both of the standard prices and of the standard gallonages at three-yearly intervals.

Mr. Morrison expressed the view that these standard prices and gallonages should meet the Union's representations that the insurance plan should so operate, in the event of a fall in prices, as to afford a reasonable measure of support to popl returns and thus provide greater security for the industry.

In response to an inquiry, the Minister said that, while

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the Government regarded the price insurance plan as the main safeguard of the industry against a serious fall in the prices of butter and cheese, there would be provision, under existing powers, or amended powers if that should be found necessary, to enable the Government to impose quantitative regulation of imports of butter, cheese, and other milk products in the event of imports being such as to lead to instability in the market for those products in the United Kingdom.

Replying to further questions, Mr. Morrison stated that the Government were fully aware of the difficulties confronting the poultry industry. Informal discussions were already in progress with the chief foreign exporting countries with a view to averting a repetition of the position that occurred in the egg market a year ago, and he would give immediate attention to the proposals for marketing reform which had just been submitted to him by the industry. He also promised consideration of the question of agricultural credit and of the other matters raised by the Deputation.

As regards bacon pigs, the industry had made considerable headway with the aid of import regulation, which was still in operation, and it was the Government's desire that the industry should develop on sound and progressive lines. Following the announcement made in Parliament last July, discussions with the Marketing Boards concerned were proceeding and it was hoped that detailed proposals would be formulated at an early date. An announcement would be made as soon as possible.

The Milk Marketing Board

Mr. Morrison also received a deputation from the Milk Marketing Board which was headed by *Mr. Thomas Baxter*, the Chairman. The Board had submitted a reasoned statement upon the White Paper in which they accepted the soundness of the principle of raising the standard of milk production by quality premiums and recognized that such a policy was in the public interest, but doubted whether the desired objective could be reached in five years upon the basis proposed. The Board also questioned the adequacy of the price insurance plan and sought enlightenment upon a number of details in the White Paper policy.

The Minister said that he had given close attention to their views. He agreed that it was difficult to estimate closely the

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effect of the assistance proposed, either in raising the standard of production or in stimulating increased consumption, and he emphasized the value of the provision referred to above for a review of the position in the third year, or earlier if the Milk Commission thought it expedient. On other points, the Minister made a similar reply to that given to the National Farmers' Union. He also promised that full consideration would be given by the Government to the Board's representations with regard to the functions of the proposed Milk Commission, to the Milk-in-Schools Scheme and to the supply of milk for maternity and child welfare centres.

FOOT-AND-MOUTH DISEASE IN GREAT BRITAIN

The following Memorandum* on Foot-and-Mouth Disease deals with: (1) The Character and History of the Disease; (2) The Policy and Procedure for Dealing with Outbreaks in Great Britain; (3) Details of Outbreaks, October-November, 1937; (4) The Measures taken to Prevent the Introduction of Infection from Abroad; (5) Research; and (6) The Export Trade in Pedigree Stock in Relation to the Disease.

1. Character of the Disease. Foot-and-Mouth Disease is caused by a virus which passes through all known filters, and which cannot be seen even with the aid of the most powerful microscope. It is not usually fatal to the animals attacked, as the proportion of deaths does not normally exceed 3 per cent. of affected cattle, with a rather higher figure amongst sheep and pigs. With young unweaned animals, however, the mortality is frequently very high. Although the disease is curable, it has secondary consequences which are often serious, especially amongst dairy herds and breeding stock. The real trouble with Foot-and-Mouth Disease is not its deadliness but its extraordinary infectivity, against which there is no known preventive agent. It is spread not only direct from animal to animal but also through many intermediate agencies, including human beings, vehicles, feeding utensils, packing materials and even rodents and birds. Every diseased animal is an active manufacturer of virus, which can be carried by these means with great rapidity. Movement, both human and animal, is now much more extended than it used to be, and infection would constantly be carried from one part of the country to another if affected animals were kept alive for treatment. Unfortunately, a diseased animal has only a very short immunity against another attack, and although the actual losses by death might not in themselves be disastrous, the total financial loss which would be suffered by breeders and dairy farmers, if once Foot-and-Mouth Disease were allowed to become endemic, would be enormous, and all stock-owners would be faced

* Dated December 15, 1937.

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with a constantly recurring menace, to say nothing of the effect on the export of British pedigree stock, which is of such high importance not only to breeders in this country, but to the meat and wool trade of the world.

2. History of Disease in Great Britain. According to the records, Foot-and-Mouth Disease first appeared in England in 1839, and from that date until 1892 the country suffered from considerable periods of severe infection. In 1862 the disease broke out in the Royal Agricultural Society's show yard at Battersea, and in 1863 animals were attacked in the Smithfield Show. In 1871, 52,000 outbreaks were officially reported and in this visitation, which continued into the following year, the number of animals attacked was estimated at about three millions. From 1880-84, 27,445 outbreaks with some 800,000 animals affected are recorded.

Notifiable from 1869. The disease was first made notifiable by the Contagious Diseases (Animals) Act, 1869, but the powers conferred thereby upon Local Authorities were permissive and not obligatory, and for some years stock owners were opposed to any compulsory measures for the suppression of the disease. Agricultural opinion gradually grew, however, in favour of drastic measures on the lines of those adopted against cattle plague (rinderpest), including the adoption of the slaughter policy by means of which that disease was finally eradicated in 1877.

Slaughter Policy introduced in 1892. It was not until 1892, however, that the power to adopt a slaughter policy was conferred upon the Board of Agriculture by the Contagious Diseases (Animals) Act, 1892. The objects aimed at by legislative action in Great Britain since that date have been :—

- (a) to eradicate the disease wherever it appears by the application of the power to slaughter, and
- (b) to protect the country by every practicable means against the introduction of infection from outside sources.

From 1892 until 1922 the number of outbreaks did not exceed 95 in any one year. The year 1922 and the two following years, however, witnessed a severe test of the slaughter policy as a means of preventing the disease from again becoming endemic, but success was eventually achieved. The outbreaks from 1922, the number of counties affected, the extent of slaughter, and the annual cost of compensation for slaughtered animals are as follows :—

FOOT-AND-MOUTH DISEASE IN GREAT BRITAIN

OUTBREAKS OF FOOT-AND-MOUTH DISEASE, 1922 TO 1937, ANIMALS SLAUGHTERED AND COST OF COMPENSATION

Calendar Year	Counties affected	No. of Outbreaks	No. of animals slaughtered					Net cost of Compensation for Animals Slaughtered
			Cattle	Sheep	Pigs	Goats	Total	
1922 ..	46	1,140	24,071	21,831	9,821	49	55,772	£ 647,627
1923 ..	43	1,929	69,256	26,170	33,304	55	128,785	1,898,211
1924 ..	52	1,440	42,737	28,362	17,548	79	88,726	1,123,194
1925 ..	26	260	8,512	8,440	2,978	33	19,963	233,784
1926 ..	31	204	5,773	11,671	2,547	11	20,002	172,464
1927 ..	23	143	4,624	3,496	1,813	7	9,940	120,467
1928 ..	21	138	4,129	5,069	2,227	16	11,441	112,632
1929 ..	15	38	1,247	1,101	1,217	5	3,570	36,376
1930 ..	3	8	42	67	195	2	306	1,626
1931 ..	19	97	3,698	5,503	1,384	4	10,649	96,454
1932 ..	11	25	629	1,608	416	—	2,653	16,521
1933 ..	23	87	3,359	3,084	1,359	3	7,805	72,399
1934 ..	15	79	2,724	5,173	2,378	27	10,302	63,367
1935 ..	12	56	2,900	7,000	2,543	1	12,444	71,697
1936 ..	14	67	2,504	1,737	1,072	3	5,316	52,480
1937 to Dec 9	21	117	5,430	11,010	5,170	8	21,618	171,274
Total net cost of compensation ..								£4,890,573

In view of the present organization and procedure for dealing with this disease it is hoped that the experience of the years 1922-24 will never be repeated. Omitting these exceptional years the total expenditure on compensation for slaughtered animals during the years 1925 to 1937 (inclusive) has been £1,221,541, or an average of £93,965 per annum. Assuming the total value of the cattle, sheep and pigs in Great Britain to be roughly £150,000,000, this is an equivalent to the payment of an insurance premium of 1s. 3d. per cent. per annum to insure this country by means of the slaughter policy against the risk of the disease becoming endemic.

The average annual number of animals slaughtered during the same years (1925-1937) is 3,505 cattle, 5,001 sheep and 1,946 pigs. As a percentage of the total animal population of Great Britain returned in June, 1937, these figures work out at about 0.04 per cent of the cattle, 0.02 per cent. of the sheep, and 0.05 per cent. of the pigs; or in other words 4 per 10,000 cattle, 2 per 10,000 sheep and 5 per 10,000 pigs have been slaughtered annually on the average in pursuance of the slaughter policy.

Regarded in the perspective of past history, the extent of the present outbreak (October-November, 1937) dealt with in paragraph 7 of this Memorandum, although serious in view of

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the extreme infectivity of the disease and the manner of its introduction, is not comparable with those of 1922 to 1926.

3. Procedure adopted in Outbreaks in Great Britain. The procedure now adopted in dealing with outbreaks which is described in paragraphs 3-6 of this Memorandum, has been built up from past experience and embodies the principal recommendations of two Departmental Committees appointed in 1922 and 1924.

Whenever Foot-and-Mouth Disease is suspected to exist on any premises in Great Britain, the owner or person in charge is required by law immediately to notify the fact to the local police, who are required at once to inform the Ministry by telegram, and also the Local Authority concerned, whose duty it is to cause a Notice to be served upon the occupier of the premises, the effect of which is to apply to them the Rules to be observed on an Infected Place to prevent the spread of infection. A Veterinary Inspector is at once instructed by the Ministry to make a diagnostic inquiry. Officers are on duty day and night ready to issue these instructions so that there may be no delay in diagnosis. If the Inspector, after examining the animal or carcass, suspects that disease exists he is required to issue a certificate to that effect and notify the Local Authority, the local police and station-master, whereupon the movement of animals out of, into or within an area lying within a radius of five miles of the premises concerned is automatically prohibited pending a definite and conclusive diagnosis by the Chief Veterinary Officer of the Ministry, to whom the Veterinary Inspector's report is communicated by telephone. The 5-mile emergency area may if necessary be extended to 15 miles or more.

4. The Slaughter Policy. The slaughter policy, which is the established policy in this country in dealing with this disease, involves the immediate slaughter, on confirmation of the existence of the disease, of all affected animals (cattle sheep, swine or goats), and also those which are or have been recently in contact with the affected animals or otherwise directly exposed to infection. The object of such slaughter is to destroy as quickly as possible the manufacturers, and potential manufacturers, of the foot-and-mouth disease virus which is so easily and rapidly spread from animal to animal and carried by numerous agencies acting as mechanical carriers to the stock of other

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farms. The slaughter of the stock on an infected place is normally completed within 24 hours of the report of the case being received by the Ministry of Agriculture. Dogs, cats, or poultry are not slaughtered, but those on infected premises are confined. Preliminary disinfection is proceeded with immediately and a thorough disinfection of the whole premises is carried out as soon as slaughter has been completed. Infected premises are subject to special Rules referred to in paragraph 3, including prohibition of movement of live animals on or off the premises, and of entry of persons other than attendants or veterinary inspectors, and disinfection of all persons and vehicles entering and leaving. These Rules are maintained for a period of about 9 weeks from the date of slaughter, except that a partial re-stocking is permitted under supervision for the final three weeks of that period.

Opinion of Departmental Committee, 1924-25. Of the slaughter policy, the Departmental Committee appointed in 1924 to investigate the widespread outbreaks of that period, said in their Report [Cmd. 2350] (pages 10, 12 and 29):—

“The control of foot-and-mouth disease is clearly a matter of national importance.”

“The manufacture of virus is on a much greater scale (when isolation instead of slaughter of affected stock is adopted) and continues for a long period, thus multiplying the risk of extension with the ultimate danger of an uncontrollable spread and of the disease becoming endemic in this country.”

“The object of the slaughter policy is the destruction of virus and its success depends almost entirely on rapidity of action in removing the source from which virus is being produced. So long as the policy is pursued with unrelenting energy and with the maximum celerity we are convinced that it is at present the only policy unless disease is to become endemic.”

“The adoption of isolation as a policy would transfer the burden of direct loss from the nation to the individual but it would undoubtedly react on the nation.”

“A policy of isolation would be equivalent in our view to the abandonment of any hope of eradicating the disease from this country.”

“We are unshaken in our belief that until a preventive agent is available, the slaughter policy should be continued.”

Compensation for Slaughtered Animals. The statutory authority for the payment of compensation is contained in Section 15 of the Diseases of Animals Act, 1894, which lays down that the basis of compensation for slaughtered animals shall be as follows:—

- (i) if the animal slaughtered was affected with foot-and-mouth disease the compensation shall be the value of the animal immediately before it became affected;

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- (ii) in every other case the compensation shall be the value of the animal immediately before it was slaughtered.

The value referred to in the Section is the actual value of the animals whether they be Attested, Accredited, Pedigree or ordinary stock.

Consequential Losses. The Act makes no provision for the payment of compensation for consequential losses. The Departmental Committee appointed to inquire into the extensive outbreaks of 1923-24 considered the question of the basis of compensation, but made no recommendation on the question of consequential losses. The difficulties are obvious, since such losses are suffered not only by the farmers occupying the infected farms, but also livestock auctioneers, market authorities and other owners of stock in infected areas whose ordinary transactions are considerably curtailed, e.g., as regards store stock, markets are entirely suspended for considerable periods.

5. Infected Area Restrictions. Concurrently with, and a necessary concomitant of, the slaughter policy an Infected Area is declared by an Order of the Minister immediately an outbreak is confirmed, embracing a radius of 15 miles around the infected premises. No movement of animals out of this area is permitted and movements of animals into and within the area are controlled by licence, only necessary movements being allowed. Markets within the area are limited to fat stock and are permitted by licence and subject to veterinary inspection, but only on premises more than 5 miles from any infected place. All dogs within five miles of any infected premises have to be kept under control and hunting in the Area is prohibited. A warning Notice to stockowners (Leaflet A.129/T.A.) is distributed widely in Infected Areas indicating the precautions to be taken and requirements to be observed to prevent the spread of infection.

The Infected Area restrictions are normally maintained in the " 15-mile " area for 14 days, when the area is reduced to one of 5 miles radius from the infected place or places, this reduced area being maintained for a further period of 7 days. Variations of this procedure may be necessary when outbreaks are more complicated.

The Size of the Infected Area initially declared (a 15-mile radius) has been criticized as being unnecessarily large in dealing with a primary or single farm outbreak. On this

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question the Departmental Committee of 1924-25 in paragraph 90 of its Report (Cmd. 2350) said:—

“It has to be remembered that before the first symptoms of disease were noticed, and any precautions taken, the animals were in a highly infective state for about 48 hours. It is essential, therefore, that until all inquiries as to origin and possible spread of disease before notification have been completed all animals which may reasonably be regarded as having been exposed to contagion should be subject to some form of control. We are unable, therefore, to recommend any reduction in the size of the area to which restrictions are applied in the first instance.”

The wisdom of maintaining the 15-mile area has been abundantly proved by experience. Not infrequently subsequent outbreaks have occurred some miles from the first reported case and some of these have been found to be of earlier origin than the one first reported. Whilst a 15-mile radius has included practically all such outbreaks, a smaller area would not have been sufficient for the purpose.

Owner's Power to Prohibit Entry of Unauthorized Persons. Another point of importance to owners in connexion with Infected Areas is that any owner having animals on premises in such an Area may, under Section 13 of the Diseases of Animals Act, 1894, exhibit a Notice prohibiting the entry of unauthorized persons into his buildings and lands without his consent. Many stockowners exercise this power and the Ministry is prepared to provide the Notices.

6. Standstill Orders. When outbreaks are more widely spread, as at present, the above restrictions are supplemented by a temporary “Standstill” Order controlling the movement of animals out of and within an Area surrounding the actual infected Areas as an additional precaution with the object of limiting the spread of infection.

7. Special Features of Present Outbreak (1937). The outstanding and most dangerous features of the present outbreak in the south-eastern counties have been its exceptional virulence, as shown by the large number of animals initially found affected, and showing recent lesions at the veterinary inquiry, and the large number of entirely unconnected centres of disease that appeared within a comparatively short period.

The present series began on October 16, at Thurning in Norfolk, and in the course of the eight weeks since that date to December 9 a total of 95 outbreaks were confirmed, distributed amongst 15 counties, all except two being in the south and east of England. The number confirmed each week, and their location, are given in the following table. Of the 95

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outbreaks, Norfolk has had 19, Suffolk 16 and Kent 15, East Sussex, Huntingdonshire and Essex coming next with 12, 8, and 8 outbreaks respectively. The exhaustive inquiries conducted into every outbreak show that some 59 centres and possibly a few more were entirely unconnected with any previous outbreak or with each other. 25 of the centres involved the declaration of either new Infected Areas or extensions of existing Infected Areas.

LOCATION OF OUTBREAKS OF FOOT-AND-MOUTH DISEASE,
OCTOBER 16 TO DECEMBER 9, 1937

County	Outbreaks During Period								Total
	Oct 16-23	Oct 24-30	Oct 31- Nov 6	Nov 7-13	Nov 14-20	Nov 21-27	Nov 28- Dec 4	Dec 5-9	
Norfolk ..	2	8	6	2	—	1	—	—	19
Suffolk ..	—	—	4	9	3	—	—	—	16
Sussex (East)	—	—	1	1	—	4	2	4	12
„ (West)	—	—	—	—	—	1	—	1	2
Kent ..	—	—	5	3	5	1	—	1	15
Essex ..	—	—	1	1	2	2	1	1	8
Lindsey ..	—	—	—	1	2	1	—	—	4
Hunts ..	—	—	—	2	4	1	1	—	8
Soke of Peterborough	—	—	—	—	1	—	1	—	2
Bucks ..	—	—	—	—	—	1	—	—	1
Surrey ..	1	—	—	—	—	—	—	—	1
Cheshire ..	—	—	—	—	—	—	1	—	1
Dorset ..	—	—	—	—	—	—	1	—	1
Northumber- land	—	—	—	—	—	—	1	1	2
Wilts ..	—	—	—	—	—	—	—	3	3
TOTALS ..	3	8	17	19	17	12	8	11	95

Standstill Order (Controlled Area) for South-Eastern Counties. The rapid increase in the numbers of outbreaks and the fact that the disease, although limited at that time to the southern and eastern counties, was occurring at so many widely separated centres in those counties, created a situation which in the Minister's opinion called for additional precautionary measures to safeguard other parts of the country as far as possible, and on November 9 an Order was issued imposing prohibition of movement of animals out of, and controlling the movements of animals into, and within an area termed a Controlled Area stretching from the Humber to the Hampshire coast and comprising the counties of Lincoln (parts of Lindsey, Kesteven and Holland), Soke of Peterborough, Huntingdon, Cambridge, Isle of Ely, Norfolk, East and West Suffolk, Essex, Bedford, Hertford, Middlesex,

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London, Surrey, Kent and East and West Sussex (including any county or other boroughs geographically situated therein), but excluding from the area any parts of such counties and boroughs that were for the time being comprised within any Foot-and-Mouth Disease Infected Area. In this Controlled Area livestock markets were limited to licenced markets of fat stock for immediate slaughter only and were subject to veterinary inspection as in Infected Areas. The progressive improvement in the eastern counties rendered it possible to withdraw the Standstill Order as from December 9, when the Controlled Area was accordingly released.

Christmas Arrangements were made as follows:—

Smithfield Show.—A Special Order was made on November 22 authorizing the Smithfield Show (December 6–10) at Islington (in the Controlled Area). Animals were permitted to be moved to the Show from any free area or from the Controlled Area but not from an Infected Area. Movement from the Show was allowed only to a slaughterhouse either in the Controlled Area or in any adjoining Infected Area but not to a free area, and the animals were required to be slaughtered within 10 days. On the release of the Controlled Area on December 9, however, these restrictions on movement from the show were revoked.

Christmas Fat Stock Markets.—An Order was issued on November 28 :—

- (a) permitting any animals sold at licensed fat stock markets in the Controlled Area to be moved back to the place of origin for detention for 14 days during which period they were permitted to be again moved by licence to a slaughterhouse. The object of this was to assist butchers who have insufficient accommodation at their slaughterhouses at one time for the animals they purchase for the Christmas trade ;
- (b) extending the time limit for slaughter of animals moved under licence to a slaughterhouse in the Controlled Area which is normally 4 days, to 10 days.

Interference with Export Trade. The following lots of animals intended for export were rendered ineligible for entry to the London Quarantine Station in consequence of outbreaks within 15 miles of the place of origin, and shipment had to be abandoned :—

- (a) nine cattle and 28 sheep for the quarantine period commencing November 11 ;
- (b) one bull, 21 sheep and 2 pigs for the quarantine period commencing November 30. Four of these sheep were on the farm of H.M. The King at the Home Farm, Sandringham.
(See also paragraph 11 of this Memorandum.)

8. Origin of Infection. Up to the summer of this year the Continent of Europe had for some two years been freer from foot-and-mouth disease than for a considerable period previously. In June the disease was introduced into France by animals imported from Northern Africa. It spread with exceptional rapidity first in France and then to Belgium,

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Holland, Germany and Switzerland. The following table of outbreaks illustrates its progress in western Europe:—

1937	France	Belgium	Holland	Germany
June	789	—	—	2
July	2,727	10	2	7
August	9,327	319	394	7
September ..	21,970	4,090	11,444	264
October	32,808	14,098	(not yet received)	3,295
November ..	22,655 (to Nov. 15)	(not yet received)		11,739

The disease thus reached dimensions in these four countries which has not been known for many years, and it is understood that in some parts of the Continent drastic restrictions have been imposed even on the freedom of movement of human beings in an endeavour to arrest the progress of the disease. Three factors connected with the Continental outbreaks have great importance in relation to this country and point clearly to the source from which infection was introduced into England, namely:—

- (1) the disease is of a particularly virulent character,
- (2) it reached the heaviest and most widespread infection at the very moment of the autumn (September to November) mass-migration of birds, from the Continent to the eastern and southern counties of England; and
- (3) in the series of outbreaks that commenced in England in the middle of October the disease has been found to be of the same type as that officially identified on the Continent. (Several types of the disease are recognized by research workers—see Paragraph 10 below)

One of the most dangerous characteristics of foot-and-mouth disease lies in the facility with which it can be conveyed long distances by mechanical means, and although it is not known whether birds are themselves naturally susceptible to infection, there is little doubt that they can carry the virus mechanically and deposit it on the pastures on first alighting in England. There is, therefore, strong circumstantial evidence pointing to the conclusion that the infection of this country in October and November was due to migratory birds acting as mechanical carriers. No organized measures against the risk of the introduction of infection by this means are, however, considered practicable.

Other theories have been advanced on the possible source of infection, including (a) hay and straw used as packing for imported merchandise, (b) imported fruit or vegetables, (c) the collection of virus on the tyres of motor cars brought

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from the Continent, (d) imported vaccine, or (e) imported animal products. No evidence has, however, been found associating any of these suggested agents with the present outbreaks. It is, moreover, a reasonable assumption that if such agents had been responsible, they would have caused a wider distribution of outbreaks throughout the country, whereas the great majority of the present series have occurred in the eastern and southern coastal counties.

9. General Measures to prevent Introduction of Infection from Abroad. The most dangerous means by which foot-and-mouth disease may be carried is through the agency of the live animal, but the importation of live animals from all countries infected with foot-and-mouth disease is definitely prohibited. The other channels through which the virus has been or may possibly be introduced include in addition to migrating birds :—

- (a) Carcasses or other animal products.
- (b) Feeding stuffs.
- (c) Hay and straw and packing materials.
- (d) Vegetables and fruit.
- (e) Movements of human beings.
- (f) Motor vehicles.

(a) **CARCASSES (MEAT): Prohibition from Continent of Europe.**—In 1926 the disease was definitely discovered in fresh pig carcasses imported from Belgium and Holland in connexion with outbreaks in Lanarkshire. As a consequence the importation of fresh carcasses from the Continent of Europe was prohibited by the Importation of Carcasses (Prohibition) Order of that year. The effect of this Order, which is still in operation, has been appreciably to reduce the number of initial or primary invasions of the disease. Following that Order investigations were conducted by the Foot-and-Mouth Disease Research Committee which proved that the virus could remain infective in the bone marrow of chilled or frozen beef for 76 days.

Arrangements with South American Governments.—In view of the risks proved to exist by the experiments of the Research Committee, representations were made to the Governments of Argentina, Uruguay, Brazil and Chile, all of whom in consequence made Regulations prohibiting the exportation to Great Britain of carcasses or parts of carcasses of animals affected with foot-and-mouth disease or of animals forming part of the same troop as the diseased animals. Special arrangements were made by those Governments for the inspection of the animals before and after slaughter. When foot-and-mouth disease is found in any troop of animals in the export abattoirs the whole of the troop after slaughter is diverted to other purposes than export to Great Britain. In order to reduce the incidence of disease in the export abattoirs a system of inspection on the farms before the animals are moved to the slaughterhouse was organized. For several years after the inauguration of these arrangements a veterinary inspector of the British Ministry of Agriculture was stationed in South America to observe their operation, and in the autumn of 1936 a further visit was paid by one of the Ministry's senior veterinary inspectors to observe existing conditions and discuss the operation of the regulations with the authorities.

The present situation can be summarized as follows :—

The Argentine.—The Argentine Government has decided to increase

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its field staff in order to intensify inspection and to extend the farm inspection of fat animals, not only of those about to be moved to the export abattoirs, but also those about to be moved to markets, with a view to reducing the circulation of animals affected with foot-and-mouth disease. The field staff will be doubled.

Certain alterations at the large market at Buenos Aires will be made with a view to the better control of any troops of animals found diseased on arrival.

Patagonia.—This province, which exports lamb and mutton to this country, has been for some years, and continues to be free from foot-and-mouth disease. Apart from the staff of veterinary inspectors sent during the season it is proposed to establish a permanent Patagonian veterinary service, partly to deal with disease in the territory and partly to deal with animals coming into the territory with a view to the prevention of the introduction of foot-and-mouth disease.

Chile.—The importation of meat from Chile to this country is confined to exports of lamb and mutton from the province of Magallanes which adjoins the Argentine province of Patagonia. Like Patagonia, the province of Magallanes has been free from foot-and-mouth disease for a number of years, and the quarantine arrangements initiated by the Argentine Government for the protection of Patagonian territory will indirectly offer protection to the province of Magallanes.

Uruguay and Brazil.—No special comment is called for in connexion with the import trade from these two countries. It is reported that the existing regulations are administered satisfactorily.

Further Preventive Orders.—Two further Orders of importance are in force in Great Britain which aim at the prevention of the introduction to animals in this country of infection by imported meat, viz. :—

(i) *The Foot-and-Mouth Disease (Boiling of Animal Foodstuffs) Order of 1932*, which requires the boiling for one hour of all animal feeding stuffs, including broken and waste kitchen refuse and meat scraps, before being fed to animals.

(ii) *The Importation of Meat (Wrapping Materials) Order of 1932*, which prescribes the use of a red striped wrapper for meat imported from infected countries and prohibits the use of these wrappers subsequently as containers for feeding stuffs or bedding for animals or for fertilizers or horticultural products which might come into contact with animals on the farm. Further, it is required that all meat wrappers shall be kept apart from animals until they have been boiled or otherwise effectively sterilized.

(b) **FEEDING STUFFS.**—In addition to the inquiries made in each initial case, a special inquiry was conducted in a series of outbreaks some years ago when outbreaks were more numerous, into the character and origin of the feeding stuffs used on the infected farms and the conclusion was reached that the possibility of feeding stuffs being the origin of infection in any general sense was extremely remote. Further, the process of manufacture of linseed and cottonseed cakes in this country include the subjection of the seeds to a temperature sufficient to kill the virus of foot-and-mouth disease. Moreover, although Scotland is a large consumer of artificial feeding stuffs unexplained outbreaks of the disease occur very rarely in that country. It is considered therefore that the adoption of any restrictive action either as regards feeding stuffs or the bags in which they are imported could not be justified.

(c) **HAY AND STRAW PACKING MATERIALS.**—The importation of hay and straw for use as fodder or litter for animals from infected countries is already prohibited by the Foreign Hay and Straw Order of 1912. These materials may be used, however, as packing for imported goods. The

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Departmental Committee in their Report issued in 1925 [Cmd. 2350] stated that the imposition of a prohibition against the use of hay or straw as packing, or to require its destruction at the port of disembarkation, would involve an interference with our overseas trade in the many articles habitually packed in hay and straw of such a far-reaching character as could only be justified by an overwhelming case. In only three of the initial outbreaks during the past 12 years has hay and straw packing material of foreign origin been implicated, but even in those cases there was no proof that this was the cause of the outbreaks. There is, therefore, no case for prohibition. Adequate protection against this risk has, however, been provided by the Foot-and-Mouth Disease (Packing Materials) Orders of 1925 and 1926, which prohibit all such packing material, whether of home or foreign origin, from being brought into contact with animals, and require its destruction when its use as packing is finished.

(d) IMPORTED VEGETABLES OR FRUIT.—Inquiries show that in only five cases over a period of many years could imported vegetables possibly have been involved in initial outbreaks of foot-and-mouth disease, and in four of these hotel refuse and swill containing scraps of foreign meat were also used, and it is equally possible that the latter might have been the origin of the disease. In the remaining case some of the vegetables were imported in sacks that might have been contaminated, but in that case also other circumstances existed pointing to alternative methods of infection. There is no evidence against imported fruit.

(e) MOVEMENTS OF HUMAN BEINGS.—The introduction of infection from the Continent by human beings who may have been in direct contact with the virus shortly before leaving for this country is a possible risk, but no outbreak has been traced to such a source. The Departmental Committee of 1925 stated that "whatever the danger of infection from this source may be we do not consider that it would be practicable to attempt to prescribe any disinfection of persons arriving from the Continent. Such a measure would not be tolerated even if the facts in support of its adoption were immeasurably stronger than they are."

(f) MOTOR VEHICLES.—It has also been suggested that motor cars may bring infection and should be disinfected on their arrival in or return to this country. Such a requirement would involve the provision of proper depots and adequate facilities for the rapid treatment of many cars, while anything less than a thorough washing would be valueless. Furthermore, the control and supervision of cars while en route to the cleaning depots and until the completion of the operation would be necessary. The expense and interference with the normal course of traffic which would be occasioned would be serious, and there is no information available to suggest that such a regulation would be justified by any risk involved.

10. Research. All research in connexion with foot-and-mouth disease in this country is carried out by the Foot-and-Mouth Disease Research Committee which was appointed by the Minister of Agriculture and Fisheries in 1924 to "initiate, direct and conduct investigations into Foot-and-Mouth Disease, either in this country or elsewhere with a view of discovering means whereby the invasions of the disease may be rendered less harmful to agriculture." The Committee consists of eminent scientists of the medical and veterinary professions; Sir Joseph Arkwright is the Chairman. Much additional knowledge has been gained by the work of this

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Committee which has issued five Progress Reports. The work of the Committee continues. In the future programme of its work attention is to be given to the problem of immunization—a problem complicated by the fact that there are several types of virus and that immunity against one type does not confer immunity against any of the others. The typing of the virus in all initial outbreaks in this country is regularly carried out. In the present series of outbreaks (Autumn, 1937) the viruses so far have all typed as "O," and information has been received that the same type of virus has been identified in the present endemic in France, Holland and Germany. The Committee has also outlined a series of experiments to ascertain whether birds are susceptible to the disease or capable of mechanically transmitting the virus.

The question has been raised whether cattle in this country could be protected against foot-and-mouth disease by inoculation with a serum such as has been used in Germany. A serum obtained from that country has been used experimentally in Great Britain, but in view of the results obtained both in the field and in the laboratory, it was decided not to proceed further with the experiments. The Foot-and-Mouth Disease Research Committee reported this year that "such serum as is at present available cannot be relied upon to protect a bovine from infection when intimately exposed to a highly infective case of disease," and the recent course of events on the Continent (see paragraph 8 above) lends strong support to that view.

11. The Export Trade in British Pedigree Stock in Relation to Outbreaks of Foot-and-Mouth Disease. The regulations of many of the British Dominions and Colonies relating to the importation of live stock require the previous examination of imported animals and the provision of a certificate that certain diseases are absent. The export trade in British pedigree stock, which is mutually valuable to breeders of the best class of stock in Great Britain and to stock raisers in the Dominions and Colonies overseas who wish to obtain the best quality foundation stock, was seriously interrupted from 1921-1928 by the embargoes which many of the importing Dominions and Colonies had found it necessary to impose in order to prevent the risk of the introduction of foot-and-mouth disease arising from the outbreaks of that disease in Great Britain.

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In order to remove this serious handicap to the trade as far as practicable, the London Quarantine Station was established in 1928 at the East India Dock, so that British pedigree stock could be isolated under official veterinary supervision for a period immediately before shipment sufficient to cover the maximum period of incubation of foot-and-mouth disease with a sufficient margin, the object being to provide all reasonable assurance that the animals shipped are free from foot-and-mouth disease and from the risk of their conveying infection to importing countries. In choosing the site for the establishment of this station particular care was taken to select a place so isolated as to eliminate any risk of the introduction from outside sources of any infection from ordinary causes.

Rigid conditions were laid down by the Minister of Agriculture and Fisheries in an Order entitled the Quarantine Stations (Regulation) Order, 1928, and in certain rules for the control of the station in order to ensure the healthy condition of animals admitted to and shipped from the quarantine station, and to prevent infection entering the station either by persons, animals, or things.

The main features of this system of quarantine are :—

- (a) no animals are qualified for admission into the station unless they come from premises in Great Britain situate outside a radius of 15 miles from any place on which foot-and-mouth disease (or cattle plague or pleuro pneumonia) has been certified to exist during the three preceding months, and unless the animals to be exported, and all other animals on the premises from which they are brought, have been examined immediately before movement into the quarantine station by a Veterinary Inspector appointed by the Minister of Agriculture and Fisheries and certified by him to be free from the above-mentioned diseases ; and
- (b) quarantine for not less than 14 days in the Station for the purpose of covering the period of incubation of foot-and-mouth disease.

The Order also provides for the movement of the animals *direct* from the quarantine station to a vessel for shipment, and requires that the animals be accompanied by a certificate of a Veterinary Inspector of the Ministry of Agriculture and Fisheries to the effect that the animals were admitted to the quarantine station in accordance with the Order, were detained and isolated in the station under official veterinary supervision for the prescribed period of 14 days, and continued during the whole of that period to be free from any of the above-mentioned diseases. The Order further provides that fodder or litter supplied for the use of the animals during the quarantine period and subsequently during the voyage must be obtained

FOOT-AND-MOUTH DISEASE IN GREAT BRITAIN

under permission given by the Ministry from districts certified to have been free from foot-and-mouth disease for at least three months.

It should be emphasized that Foot-and-Mouth Disease is dealt with in Great Britain by the slaughter policy whenever and wherever it appears, accompanied by efficient methods of disinfection and drastic restrictions on the removal of animals in infected areas, including entire prohibition of movement out of such areas. It is not endemic in Great Britain, and has not been present in an endemic form since the slaughter policy was introduced. The possibility of the existence among exported stock of what are known as "carriers" of infection, i.e., animals which have passed through the stages of the disease, and which in a very small percentage of instances may in consequence become "carriers," is thus entirely eliminated.

The London Quarantine Station is under the management of the Ministry of Agriculture and Fisheries. During the period of its operation, i.e., since 1928, the number of animals that have passed through the Station en route to the Dominions and Colonies are as follows. In no instance has foot-and-mouth disease been conveyed by any of these animals.

TOTAL NUMBER OF ANIMALS EXPORTED THROUGH THE LONDON
QUARANTINE STATION ANNUALLY SINCE 1928

Country of Destination	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937 up to 14/12	Totals
Antigua ..	—	—	2	—	2	—	—	—	—	—	4
Australia ..	—	253	225	91	49	103	138	119	174	210	1,362
Barbados ..	—	—	—	—	—	2	—	—	—	—	2
Canada ..	—	—	—	—	—	29	10	97	118	107	361
Cyprus ..	—	2	—	—	—	—	—	—	—	—	2
Gold Coast ..	—	—	8	—	—	—	—	—	—	—	8
Irish Free State ..	174	54	112	38	37	—	25	26	24	28	518
Northern Ireland ..	—	3	—	—	—	—	—	—	—	—	3
Nigeria ..	—	2	—	—	—	—	—	—	—	—	2
Palestine ..	—	5	3	9	—	9	1	—	—	—	27
Northern Rhodesia ..	—	20	—	—	—	—	—	—	—	—	20
Southern Rhodesia ..	31	130	53	11	4	5	6	2	7	7	256
Union of South Africa ..	128	152	200	230	217	147	192	319	465	408	2,458
South-West Africa ..	—	15	24	1	3	—	—	—	—	—	43
Trinidad ..	—	7	—	—	3	—	—	2	—	—	12
TOTALS ..	333	643	627	380	315	295	372	565	788	760	5,078

MARKET ANEMONES FROM CORNWALL & DEVON

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About the year 1924, Canon Boscawen, of Ludgvan, experimented and demonstrated that de Caen anemones could be raised from seed, and that good crops of flowers could be produced during the winter months in the mild climate of West Cornwall. The commercial value of this crop was not at first fully realized by flower growers, and at that time the markets were well supplied with French anemones, which continued to arrive in increasing quantities up to 1931. The Horticultural Superintendent first demonstrated the possibilities of this crop at the Gulval Experimental Station, and this work was subsequently repeated at Elbridge in East Cornwall and also in Devon by the County Staff.

In 1932 a duty of 9d. per lb. was imposed on the imports of anemone flowers, and a great opportunity was thus afforded for an expansion of the anemone area, which at that time was less than 50 acres. In 1931 the Dutch had introduced the anemone "peas" or "pips," i.e., small corms that are now almost universally used as planting stock. From these a plant that will flower freely during the winter can be produced without the difficulty and uncertainty that attends raising plants from seed.

Anemone growing began in the Penzance area, and it has spread out westward towards Lands End, north to St. Ives and eastwards towards Helston, to form what is now the major producing area in the county. The second important area in Cornwall where anemones of fine quality are now produced is the Valley of the Fal, where the deep fertile soils provide the anemone plant with a good rooting medium and anemones of excellent quality are produced.

In the Tamar Valley the soil on the steep hillsides is often too shallow and too hot in the summer to provide the optimum conditions for anemones, but they are grown, with success, on both sides of the river. In South Devon anemones are successfully grown in the Kingsbridge and Dawlish areas and in North Devon at Branton and Barnstaple,

MARKET ANEMONES FROM CORNWALL AND DEVON.

Area Devoted to the Crop. As the number of anemone growers exceeds 1,000, it is difficult to obtain an accurate record of the acreage devoted to the crop. The crop is normally sold in non-returnable boxes of special types, and it is possible to estimate the acreage from the number of boxes sold, allowing for the use of 2,150 boxes to the acre (2,000 in a dry year and 2,200 in a good year). The sales of anemone peas provide confirmatory information. The manufacturers have given statistics of the sales of anemone boxes, and these are summarized as follows:—

1933-34.—70,000 boxes were sold by one firm. It is estimated that 180,000 boxes were used for the crop, sufficient for an area of 88 acres.

1934-35.—Though the area had increased, growth was seriously affected by the summer drought, and flower production was not up to the average. 250,000 boxes were sold in Cornwall, sufficient for an area of 126 acres.

1935-36.—In this season box sales increased surprisingly (each manufacturer reported a considerably increased sale over the previous year) and the total boxes sold in Cornwall amounted to 646,000 or sufficient for an area of 300 acres.

1936-37.—The sales of boxes during the past season have exceeded a million, of which it is estimated that 900,000 have been used for anemones, sufficient for an area of 409 acres.

Only 90 per cent. of the boxes sold are estimated to have been used for anemones, since the boxes are used also for polyanthus and violets.

In Devon there were from 75 to 90 growers with an estimated acreage of 25 acres in 1936-37.

The total acreage of anemones in 1936-37 is therefore estimated to have been:—

Cornwall	..	409 acres
Devon	..	25 "

or a total of 434 acres. In other words an estimated progressive increase since 1931 from under 50 acres to over 430 acres.

Quality. Anemones have many attributes that make for their popularity as cut flowers—their long lasting qualities, attractive colour range, stiff stems with the green collar of bracts that obviates the need for additional foliage, and, above all, their winter blooming habit. The demand, however, is only for anemones of first-class quality, and improvement of this should be the constant endeavour of the growers.

When "English" anemones were first produced they compared unfavourably with French anemones, particularly in the shortness of their stems and limited colour range. Striking improvements in length of stem, size and colour range of the



Photograph Copyright R. A. Malby & Co.
De Caen Anemones.

MARKET ANEMONES FROM CORNWALL AND DEVON

flowers have been secured, while continuous supplies through the winter can now be obtained. An important factor in these improvements has been the close contact of the County Horticultural Staffs and the Provincial Advisory Centre (Seale Hayne College) with the industry, and the confidence of the growers in the value of the educational and experimental work, research and advice of these officers.

A Market Bunch. The flowers in a market bunch should, when fully grown, expand to 3 or 4 inches in diameter and should have stems 12 to 15 inches in length to the base of the bracts. The colours included in the bunch are perhaps 3 scarlet, 2 pink, 1 rosy magenta, 1 white (with red or blue zone at the base), and 5 in shades of purple, blue and violet.

To secure a good range of colours the growers often purchase corms of named scarlet varieties, of which His Excellency and Hollandia are the best known. In addition the Dutch corm raisers now claim to guarantee to supply a mixture containing a certain percentage of reds—30 per cent. being a desirable proportion. This may yield too many reds at the beginning and end of the season when the scarlet anemones crop more profusely, but certainly results in a satisfactory colour range throughout the season. Mauve and "dirty" whites are not wanted and are being gradually eliminated. During the seasons 1935-36 and 1936-37, newer named varieties, e.g., Sylphide and Gertrude (single), bright rosy magenta anemones, and the Admiral (double) have been widely introduced. Research work on flower-colour in anemones has been started at Seale Hayne College.

Length of Stem. Soil conditions are of major importance, and their connexion with stem length has been closely studied by the Advisory and Education Officers in the Province.

Preparation of the soil is a matter that must, and does, receive the most careful attention of successful growers. For example, where anemones with stems 15 to 20 inches long are now being produced, preparation is begun the autumn before planting anemones. On an intensively cultivated holding, this consists of deep ploughing, with subsoiling, if this has not already been done, the addition of manure, followed by repeated working, liming in late winter, and a further application of some form of manure into the surface layers in the spring. The quantity of manure applied varies according to the nature and previous cropping of the land.

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Correct spacing of the corms is essential; this has also been the subject of experimental work. It has been shown that the corms must be sufficiently closely planted to form a plant that covers the ground, making a thick stratum of leaves through which the plant throws up its flower stems to reach the light required for their expansion. A slight moulding up of the rows in autumn also contributes to this result. On fertile soils suitable for anemones a spacing of corms 4 in. apart in rows 15-18 in. apart is now generally found to be best.

During the seasons 1935-37, experiments were carried out with the object of stimulating greater length of stem, by using Dutch lights to cover the growing plants. Although the earlier results were unsatisfactory, more recent trials at Gulval have proved promising.

Windbreaks have, however, proved useful and undoubtedly promote the production of longer flower stems. Temporary windbreaks, or rather wind filters, are now widely used and at present the most satisfactory appear to be those made of 1-in. builders' laths nailed vertically $\frac{1}{2}$ -in. apart to a framework 4 ft. high. The number used round the beds to form rectangular enclosures depends on the degree of exposure of the land and the preference of the grower.

Healthy Stock. Although the anemone plant is not subject to diseases and pests of an alarming nature, it is peculiarly sensitive to environmental conditions, and if these are unfavourable they may have an immediate and disastrous effect on the quality of the flowers produced. It is greatly to the advantage of the industry that the health of the plants has from the first been studied by the Advisory and Research Officers at Seale Hayne College and by the County Staffs. A survey of the pests and diseases affecting anemones and their control was published in 1934.*

"Winter Browning" is the major failing afflicting the anemone. Attacks were reported in 1926, 1930 and 1932, and again in 1936-37, when the trouble was widespread. Investigation has brought in the mycologist, physiologist and soil chemist. The conclusions now arrived at indicate that the trouble is of a physiological nature, though secondary fungal infection may occur later. The anemone is very susceptible to unsuitable soil conditions and unless these condi-

* Seale Hayne Agricultural College, Department of Plant Pathology, Eleventh Annual Report, for the year ending September 30, 1934. Pamphlet No. 44. ■

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tions closely approximate to the optimum, the health of the plant rapidly deteriorates. In the first place, good drainage, using raised beds if necessary, thorough cleaning and preparation before planting, and care in cultivation to avoid damage of the roots, are essential. Secondly, a correctly balanced soil must be secured, and this aspect has been closely studied by the soil chemist. It has been established that acid soil conditions are definitely deleterious to anemones and a minimum pH of 6.6 is necessary. In consequence, growers have been eager to take advantage of the soil analysis service available at Seale Hayne College.

The basal manures have also been the subject of research. It is noteworthy that the best soils for anemones are fertile loams, not spoilt by previous injudicious manuring, and supplied with, when available, a generous basal dressing of some bulky organic manure.

The falling off of available nitrogen during the winter, due to leaching by rain, which is always heavy in the south-west, and to the reduction of bacterial activity at the lower winter temperature, results in conditions that indicate the probable value of top dressings, which are still the subject of research. At present the best results have generally been secured by a top dressing of nitro-chalk applied in November or early December, if and when the foliage takes on a yellowish tinge.

Finally, the importance of good water-holding capacity, especially during the summer months, when the plants are growing, has been established. Many Cornish soils are deficient in humus and dry out too quickly; a few are too heavy. Peat has been found to be valuable in this connexion and is now added to the soil by some growers.

The Choice and Planting of Corms. The planting stock, apart from seed, consists of corms graded according to their circumference. The grades chiefly used are the 1-2 cm. size, known as "peas," the 2-3 cm. size, often called "beans," and the less-used 1-1½ cm., known as "dust." Recently, closer grading into sizes 1-1½, 1½-2½ and 2-3 cm. has been introduced. The importance of close grading is that the correct time of planting depends on the size of corms used, modifications being necessary under exceptional weather conditions. The time of planting has been the subject of experiment by the County Education Officers, by Seale Hayne College, and by the growers themselves, and is now satisfactorily established. Seed is sown in March or April, 1-1½ cm.

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corms at the end of April or May, 1-2 cm. corms at the end of May or June, and 2-3 cm. corms in July. Details of cultivation, e.g., careful shallow hoeing, hand weeding, picking off early flowers, and general "hygiene," have been demonstrated on the County plots and persistently advocated, and are now well known to growers.

Results of trials on the County Council Demonstration Plots are published annually, and a pamphlet, *The Cultivation of Anemones*, by H. W. Abbiss, Horticultural Superintendent to the Cornwall C.C., is also available.

Economic Considerations. Though the crop has been grown by the larger flower growers in West Cornwall, only 2 or 3 holdings are known where the crop occupies more than 10 acres. Possibly on 25 holdings the area may exceed 2 acres and on 50 it may exceed 1 acre. Most growers have from $\frac{1}{4}$ to $\frac{1}{2}$ an acre. All classes, flower growers, farmers and cottagers have become anemone growers. The number of growers in Cornwall exceeds 1,000, while there are 75 to 90 in Devon, where the largest area is about 2 acres.

To all growers the anemone crop is now an important one; the small grower finds that he can produce them as well as the owner of a large holding, since neither horses nor expensive machines are required. This can be said of very few crops to-day, and it is noteworthy that some of the highest quality anemones are grown on holdings having a total area not exceeding 2 acres. In contrast to bulb flower crops the capital outlay in establishing a field of anemones is relatively low—an important fact for small growers, of whom there are so many in Cornwall. Employers of labour find in anemones a crop for which they can give continuous employment over a relatively long period; this is perhaps most important of all to owners of holdings of 5-15 acres—owners who prefer to have a permanent staff. On the larger holdings, a few acres of anemones fit very well into the general scheme, and provide the grower an opportunity of keeping together his casual labour for a relatively long period, often, indeed, making all the difference in enabling him to keep a good staff by the offer of semi-permanent employment. The operations calling for hand labour on this crop are fairly evenly spread over a period from June to April, and, if a proportion of the crop is grown from small corms or seed, labour can be employed throughout the year. Money returns are obtained

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from anemone flowers during the winter months, when they are particularly required to meet the weekly wage bills.

Initial Outlay. The number of pea corms required to plant an acre of land varies from 80,000 to 140,000. A reliable mixture with a good colour range costs the grower £20 to £30 per acre according to the spacing. Where beds of separate colours, such as scarlet or magenta, are grown, up to 10s. per 1,000 may be paid for the corms. When seed is used, 8-10 lb. are required per acre, costing 30s.-32s. 6d. per lb.

The cost of windbreaks made from builders' laths is approximately 2s. 6d. for a 9 ft. length and these should last, with small repairs, for at least 6 years.

In addition, there is the cost of manures, boxes, paper, freight and salesmen's commission, all items of expenditure incurred by the grower.

Local Labour. The anemone crop requires much hand labour. Moreover, to grow them successfully, it is not possible to economise on labour. The labour employed is largely female and is paid by the hour, piece-work being generally considered unsatisfactory owing to the careful work required.

One grower with a holding of 11 acres formerly employed one man and a boy when growing farm crops only—now that he has 8 acres to anemones he employs 14 girls and 2 men throughout the year, with additional casual labour. Growers state that they can offer permanent employment to 2 women per acre.

Hand weeding is necessary and an acre would occupy 6 women for 3 days, so that in a season the hand weeding of an acre may cost £20 or more. Picking, grading and tying the flowers from an acre may cost £30. Further items may bring the total labour bill to over £65 per acre, though in many instances much of the work is done by the small holders and members of the family. On the whole, the wage value of this crop in Devon and Cornwall is approximately £30,000 a year.

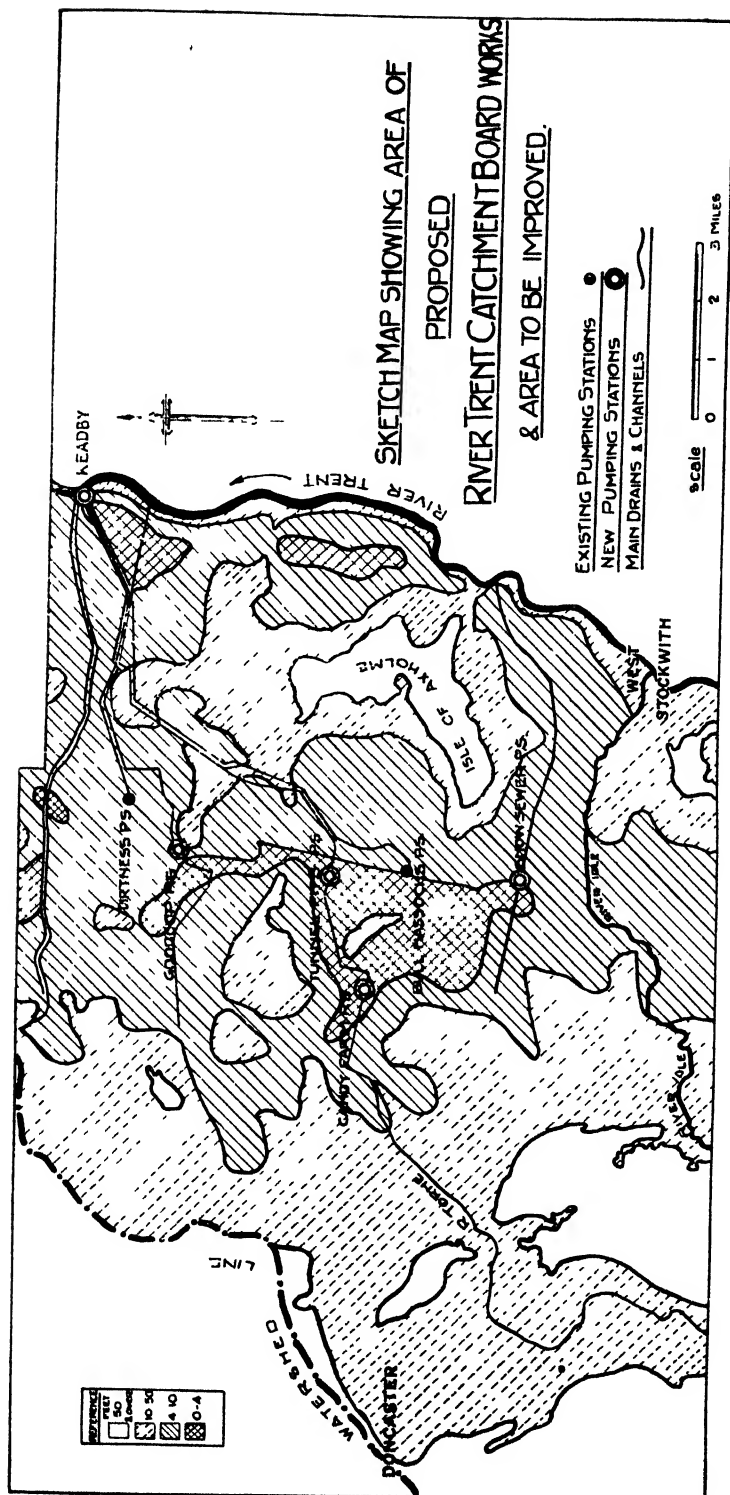
Great developments have taken place, and the quantity of anemones now marketed—some 13,000,000 bunches annually—has made these flowers very popular in countless homes. There is no relaxation of the effort to produce flowers of improved quality, and continued research and experiment gives every encouragement to the prospect of still greater improvement in the quality of the blooms available for that most exacting customer—the English purchaser.

LAND DRAINAGE: SOME REMEDIAL WORKS IN THE RIVER TRENT CATCHMENT AREA

A Report was recently issued by the Ministry on the operations and proceedings under the Land Drainage Act, 1930, from the passing of that Act on August 1, 1930, to March 31, 1937 (H.M. Stationery Office, Price 1s. 6d.), and although that Report afforded information as to the capital works now being carried out by Catchment Boards in different parts of the country, the cost of which will (according to the latest estimates) exceed the sum of £7,000,000, it did not profess to draw any conclusion as to the benefit likely to be conferred by those works, many of which will obviously take some years to complete.

It is the object of the paragraphs that follow to give an account of certain specific works that are now being carried out by the River Trent Catchment Board, and to throw some light on the benefit that may be expected rapidly to follow the completion of these works. Moreover, it is hoped to include in future numbers of this JOURNAL further notes of this character, dealing with works being carried out in other catchment areas, and indicative of the advantages that have been derived from and may be expected from the considerable expenditure now being incurred by Catchment Boards with the aid of Government grants for the purpose of flood protection.

The area covered by these Notes forms parts of what is usually known as the Doncaster Drainage District. This district, of which the northern half lies in the Yorkshire Ouse catchment area and the southern half in the Trent catchment area, covers part of the South Yorkshire coalfield, and because of this, is subject to subsidence on account of coal mining operations. As a result of the investigations of a special Commission which reported upon the district in 1928, and of the subsequent Doncaster Drainage Act of 1929, a special Drainage Board was constituted to administer the district. For various reasons that need not be embarked upon here, the Doncaster Drainage Board had to be abolished by an Act of 1933, and its special powers in relation to the coal mining industry were transferred to the Yorkshire Ouse and Trent Catchment



LAND DRAINAGE—TRENT CATCHMENT AREA

Boards, who became also responsible for maintaining the main watercourses of the area.

The particular works under reference serve the major portion of that part of the Doncaster Drainage District lying within the Trent Catchment Area. The area, some 120,900 acres, is indicated in the accompanying outline map (supplied through the courtesy of the Trent Catchment Board), and as will be seen from the contours, is, for the most part, low lying. Certain of the lands are as low as 2 ft. O.D. and are therefore 16 ft. below the level of the Highest Spring Tides.

Reference should be made to the map in order that the existing complicated system of drainage may be understood. It may here be mentioned that the framework of this system was laid down early in the 17th century by that famous Dutch Engineer, Vermuyden. It will be seen that two drains, namely the River Torne and the Hatfield Waist Drain, cross the area from west to east and discharge into the Trent at Althorpe and Keadby respectively, near the north-east corner of the area. These two drains are intended to act as carriers for conveying the water from the higher land, situated at the west of the area, across the low lands to the Trent, storing the water at high tide between flood embankments and discharging it during low tide. There are in addition, two pumping stations known as the Bull Hassocks (South Engine) Pumping Station and the Dirtness (North Engine) Pumping Station, each provided with an outfall drain discharging into the River Trent at Keadby. The object of these stations is to lift the water from the lower parts of the area to such a height that it may gravitate *via* the outfall drains to the river at low tide.

The main defect of the present system is that during times of flood the low tide level of the River Trent is seriously elevated, rendering discharge from the four drains mentioned difficult, and at times impossible. The storage capacity in the drains being totally inadequate to deal with such a situation, flooding of large areas occurs. Indeed, during the flood of 1932, when the tidal gates did not open for five consecutive periods of 24 hours, very serious flooding occurred. This is not the only defect of the present system, for, apart from this, the sizes of the drains are inadequate in relation to the slope available; the pumps cannot lower the water sufficiently even in normal weather to give a correct water table; and many parts of the area that have to rely on gravity only for discharge are heavily waterlogged throughout the year.

LAND DRAINAGE—TRENT CATCHMENT AREA

The proposals of the Trent Catchment Board, estimated to cost £250,000, upon which work has already started, seek to remedy this lack of efficient drainage and to bring back into active cultivation large areas of land that have become derelict.

These proposals, which are referred to generally as the Keadby Pumping Scheme, may be grouped under three separate sections. First, the erection of a large pumping station at Keadby to discharge the water from the main drains into the River Trent at times when the gravity flow is retarded or held up completely by the elevated low-tide levels. The pumps, six in number, to be installed at this station will be capable of discharging 1,092 tons of water a minute or rather more than two-thirds of the quantity discharged by the largest land drainage pumps in this country installed a few years ago at St. Germain's by the Middle Level Drainage Commissioners. Secondly, the enlargement, regrading and embanking of the four drains previously mentioned; the diversion of the River Torne from Althorpe to Keadby; and the provision of a catchwater drain to intercept the water flowing off parts of the western slopes of the high land forming the Isle of Axholme. Thirdly, the construction of three further pumping stations within the area at points marked, Goodcop, Tunnel Pits and Candy Farm; and the reorganization of the existing pumped areas so as to render them more effective. These three new pumping stations, together with the existing stations at Dintness and Bull Hassocks, will serve to pump the water from the low-lying areas, a total of some 34,600 acres, into the renovated main drains leading to Keadby, there to gravitate or to be pumped into the River Trent according to the conditions prevailing.

A fourth work, which, although not strictly part of the Keadby Scheme is closely allied to it, is the provision of a pumping station at Snow Sewer. This station, which will have a pumping capacity of 152 tons per minute, will serve an area of some 8,550 acres, part of which is at present ineffectually drained by the Bull Hassocks pumping station, and parts of which depend upon gravity discharge *via* an old Warping drain (Snow Sewer). The water will be pumped up to a sufficiently high level into the Warping drain so as to be able to discharge by gravity at low tide into the Trent at Owston Ferry. The benefits of these four sets of works will be two-fold in that they will not only provide for protection from floods but will enable also a sufficiently low water-table to be

LAND DRAINAGE—TRENT CATCHMENT AREA

obtained at all times, so directly improving some 43,150 acres of waterlogged and derelict land, thereby bringing it into cultivation, and indirectly improving a much larger area of higher land.

Important works are being carried out or are in contemplation in other parts of the Trent Catchment Area, and the estimated cost of the present programme is £1,000,000, towards which the Ministry is contributing a 30-per-cent. grant, this being the first instalment of a Comprehensive Scheme estimated to cost approximately £2,250,000. It may be possible in some future article to give an account of the completed works at Keadby, and of the Trent Catchment Board's scheme as a whole.

ANNUAL CONFERENCE OF POULTRY INSTRUCTORS

As already briefly recorded in the JOURNAL for last November, the Fourteenth Annual Conference of Poultry Instructors was held at the Middlesex Guildhall on October 20, 1937, under the chairmanship of Mr. P. A. Francis, O.B.E., the Ministry's Poultry Commissioner. The following is a more comprehensive account of the proceedings.

Sir Donald Fergusson, K.C.B., Permanent Secretary to the Ministry, in opening the proceedings, said that the Conference provided a valuable opportunity for workers in different parts of the country to share their knowledge and experience for the common benefit and to keep abreast of research developments. The responsibilities of the Poultry Instructors were particularly heavy at the present time in view of the serious difficulties that confronted the industry. Disease was the fundamental problem, for once the health and vitality of stocks had been raised to a satisfactory level, poultry keepers would be far better able to face the temporary difficulties created by the inevitable variations in the cost of feeding stuffs. Consideration of a comprehensive policy to deal with poultry diseases generally had, of course, to await the report of the Poultry Technical Committee, but in the meantime details of a scheme under the Agriculture Act, 1937, were under examination, and it was hoped to bring it into operation before very long. A valuable beginning in the campaign against poultry mortality had been made possible by Section 24 of that Act, which enabled facilities to be provided for owners of Accredited Poultry Breeding Stations to obtain free veterinary services, such as the inspection, testing and examination of live or dead poultry. He hoped that a real advance towards the solution of the enormous problem of poultry and animal disease would be made in the next few years as a result of the new veterinary service proposed under the Agriculture Act and the inauguration of the general campaign against disease. Poultry Instructors had a vital contribution to make towards the reduction of the disastrous and increasing mortality of stocks, for upon them largely depended the dissemination of the principles of poultry hygiene.

POULTRY INSTRUCTORS' CONFERENCE

Mr. S. S. Monro, B.Sc. (McGill), M.Sc. (Wisconsin), Poultry Geneticist to the Canadian Dominion Experimental Farm System, read a paper on "The Value of Pedigree Breeding for Egg Production." He said that the history of pedigree breeding revealed a rapid advance in performance over a period of 10—15 years, followed by a levelling off and relative constancy for the last decade. The reason for this phenomenon was that during the earlier period environmental conditions had been considerably improved, whereas in the last 10 years few changes in this direction had been effected. Records also showed that the superiority of individual breeders was almost invariably of a temporary nature, for successes were sporadic and in no instance repeated over a period of more than four years. The explanation was to be sought in the possession by the breeder of a single outstanding prepotent male, the dissipation of whose blood in subsequent generations reduced the productivity of the flock to the average level. Such prepotent sires were extremely rare, and the individual breeder with his limited resources could do little to establish a permanently superior flock by employing selective breeding methods, since degeneracy usually followed intensive line breeding. The remedy lay in an organized scheme whereby hundreds of unrelated males could be kept under surveillance and their prepotency measured by their daughters' productivity. The outstanding sires might be brought to a central breeding station and there systematically mated to a foundation flock of average females. By bringing in new superior unrelated males from the hundreds under test each year, and breeding to daughters of superior males of the previous year at the central station, a flock of superior permanent egg-producing potentialities could be built up, from which eventually the entire country could be restocked. The scheme could be operated either by the co-operation of private breeders or by the establishment of a national breeding organization under a central administration large enough for the progeny testing of 200-500 males each year. It was only in this way that the fullest and most effective practical use of pedigree breeding could be made.

Mr. D. H. Dinsdale, M.A., Adviser in Agricultural Economics, King's College, Newcastle, read a paper entitled "The Chief Factors Governing the Financial Returns from Poultry Keeping Enterprises under present Conditions."

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The causes of the success or failure of individual enterprises were heterogeneous, he pointed out, and hardly admitted of effective generalization, but the main factors governing financial results for the industry as a whole were the following: the price of foodstuffs, the incidence of disease, the cost of labour, and the selling prices of eggs and poultry products. The food bill was estimated to be about 57 per cent. of the total costs, so it followed that the rise of 35 per cent. in food prices that had occurred in 1937 represented an increase of 20 per cent. on total costs—and, since selling prices had not moved in the same ratio, the conclusion was clear. The effect of the disastrous and increasing mortality of stocks was obvious. Among poultry keepers generally, especially general farmers, there was a failure to appreciate the value of skilled labour, and a tendency to consider carpentry qualifications as more important than a knowledge of poultry husbandry. The interaction of such factors as the employment of unskilled labour, the incidence of disease, increased replacement costs and heavier feed bills was, of course, cumulatively bad, while ignorance or unskilled management was the over-riding factor. The mixed farm flock was not usually separately accounted and thus might continue indefinitely as an uneconomic unit.

Mr. F. Blakemore, M.R.C.V.S., D.V.S.M., Advisory Veterinary Officer at the Institute of Animal Pathology, Cambridge, read a paper on "Investigations in connexion with Fowl Paralysis." He referred to the tendency to attribute to this disease all cases characterized by paralytic symptoms, and said that for this reason it would be less misleading to use the more scientific term, Neuro-lymphomatosis, in place of the popular name—Fowl Paralysis. Much research had been carried out with the object of ascertaining the cause of Neuro-lymphomatosis, but the lack of an accurate method of diagnosis of the disease during life had been a great obstacle. The blood picture, the complement fixation, the precipitin and the formogel tests had proved unsatisfactory, while clinical methods were valueless as a practical means of diagnosis. The problem of the infectivity of the disease had been the subject of much investigation. Cultures of the organs of affected fowls had always failed to reveal bacteria, and so transmission of the disease had been attempted by the inoculation of the diseased tissue into healthy stock. Inconclusive results,

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however, had been common because of the difficulty of obtaining control fowls known to be free from the disease. It had been established that the disease could be set up in this way in a limited number of cases, but the nature of the infective agent was unknown. Fowl Paralysis could develop in fowls free from parasites as well as in those heavily infested, so that intestinal parasitism could not be held to be primarily responsible for its causation, although the possibility remained that parasites might predispose fowls to the condition. Since Fowl Paralysis frequently appeared on a farm after the introduction of fresh breeding stock, and was often confined to one particular strain, there was reason to suppose that a high susceptibility to the disease might be inherited. The evidence of experiments supported the view that the transference of infection through the egg might be a very important factor in the spread of the disease. The information obtained indicated the desirability of further study of the possible transmission of the disease by the male, and of the development of fowl paralysis in the progeny of parents that show the symptoms of the condition. The breeding experiments at Cambridge had shown that there was a tendency for the disease to disappear as a result of inbreeding, but much more confirmatory evidence was necessary before this could be assumed to be a customary occurrence.

Capt. E. T. Halman, M.A., of the Poultry Nutrition Section of the Animal Nutrition Research Institute, Cambridge, gave a paper on "Internal Egg Faults in Relation to Education and Marketing." He said that the primary object of Egg Laying Trials was to give the poultry keeper reliable information as to the laying potentialities of his flocks, but their educational value in this respect was obviously largely confined to newcomers to the trials. An attempt had been made to extend the usefulness of the trials by the institution of Cockerel Breeding Schemes, the objects of which were to test the breeding potentialities of the high producers, and to make available to breeders sires of high quality. It was now suggested that the trials might usefully be employed to obtain evidence of the nature and distribution of internal egg faults, for the development of the National Mark Egg Scheme had shown that the internal quality of the egg, which was of primary importance to the consumer, could not be gauged by external appearance,

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since English new-laid eggs were sometimes rejected owing to the presence of internal faults. This suggestion, which had already been adopted by some counties, should not involve any considerable extra expenditure for labour and record keeping. The satisfactory operation of the scheme depended upon the observance of the following principles:—

- (a) the entire output of eggs must pass through the packing station,
- (b) each egg must be identified with the bird's number and date of laying,
- (c) the eggs must be consigned to the packing station in standardized packages and at regular intervals, and
- (d) care must be taken to ensure good storage conditions at the Laying Trial Ground while awaiting dispatch.

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Milk Marketing Scheme. The wholesale price for liquid milk (other than tuberculin-tested milk) in November, 1937, was 1s. 6d. per gal., 1d. per gal. more than in November, 1936. The wholesale price for tuberculin-tested milk in November, 1937, was 1s. 8d. per gal.

Pool prices for November, 1937, are given below, with comparative figures for October, 1937, and November, 1936.

					<i>Pool Prices</i>		
					<i>Nov.</i>	<i>Oct.</i>	<i>Nov.</i>
					<i>1937.</i>	<i>1937.</i>	<i>1936.</i>
					<i>d.</i>	<i>d.</i>	<i>d.</i>
Northern .. .. .	..	..	..	..	15½	14	13½
North-Western .. .. .	..	..	..	..	15½	14	13½
Eastern .. .. .	..	..	..	..	15½	14½	13½
East Midland .. .. .	..	..	..	..	15½	14½	13½
West Midland .. .. .	..	..	..	..	15	13½	13½
North Wales .. .. .	..	..	..	..	15½	14	13½
South Wales .. .. .	..	..	..	..	15½	14	13½
Southern .. .. .	..	..	..	..	15½	14½	14
Mid-Western .. .. .	..	..	..	..	14½	13½	13½
Far-Western .. .. .	..	..	..	..	14½	13½	13½
South-Eastern .. .. .	..	..	..	..	15½	14½	14½
Unweighted Average .. .. .	..	..	..	..	15·30	14·05	13·55

These prices are exclusive of any premiums for special services and level deliveries, and also of the accredited producers' premium of 1d. per gal. and the tuberculin-tested producers' additional premium of 1d. per gal. The estimated gallonage on which quality premiums have been earned was 27,765,671.

The inter-regional compensation levy was fixed at 1d. per gal., compared with 1½d. per gal. in November, 1936. Sales on wholesale contracts were as follows:—

					<i>Nov., 1937</i>	<i>Nov., 1936</i>
					<i>(estimated)</i>	
					<i>Gal.</i>	<i>Gal.</i>
Liquid .. .. .	..	..	..	..	50,383,910	46,508,102
Manufacturing .. .. .	..	..	..	..	12,079,869	18,132,585
					<hr/>	<hr/>
					62,463,779	64,640,687
					<hr/>	<hr/>
Percentage liquid sales .. .. .	..	..	..	..	80·66	71·9
Percentage manufacturing sales .. .. .	..	..	..	..	19·34	28·1

The average realization price of manufacturing milk during November was 7.525d. per gal. compared with 5.78d. per gal. for November, 1936. The quantity of milk manufactured into cheese on farms was 938,576 gal. compared with 2,077,424 gal. in the previous month and 702,329 gal. in November, 1936.

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Producer-Retailers' Records. The Milk Marketing Board at their meeting on November 15, 1937, decided that they will not regard it as a breach of the conditions of the Producer-Retailer's Licence if the "daily record" of the production, intake and sale of milk is completed to the nearest gallon, and, therefore, the column headed "Pints" need not be completed.

The "daily record" is required for transactions from the date on which the amendment to the Scheme came into force, namely, October 1, 1937, and is to enable the Board to carry out the provisions of the Scheme as amended. The Board have made it known that they have no intention of conducting an investigation into the returns of producer-retailers made before October 1, by comparing them with the information in the daily records now being kept.

The Board have also stated that during the period of the existing Producer-Retailer's Licence, it is not their intention to prescribe the form of Rounds Book to be kept under Clause 9 (2) of the licence.

Bacon Marketing Scheme. Bacon Sales Quotas, 1938. The Bacon Marketing Board have determined curers' sales quotas for the period of six months, namely, January 1 to June 30, 1938. Under this determination, the total quantity of bacon produced from pigs or carcasses of pigs produced in Great Britain, which may be sold by registered curers during the above period, is 1,497,338 cwt. The amount of each curer's sales quota has been determined on the same basis as was prescribed for the twelve months ending December 31, 1937.

Pigs Marketing Scheme. Annual Board Elections, 1938. February 26, 1938, has been selected as the date for meetings to be held for the election of district members of the Pigs Marketing Board for the South-Western, South-Eastern, Eastern and East Midland districts. The General Meeting of registered pig producers for the election of two special members of the Board has been fixed for March 31, 1938.

Potato Marketing Scheme. Riddle Regulations. On December 2, 1937, the Potato Marketing Board made new riddle regulations to supersede those made on August 26, 1937, and to come into operation forthwith. The new minimum riddle for the varieties King Edward, Red King,

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Golden Wonder and Gladstone is $1\frac{1}{8}$ in., and for all other varieties $1\frac{1}{4}$ in.

Supplies and Prices of Early Potatoes in 1937. *Home Supplies.* The area under early potatoes (both first and second earlies) in Great Britain showed a slight reduction in 1937, and amounted to 105,382 acres, as against 106,291 acres in 1936, and 112,186 acres in 1935 (according to the Potato Marketing Board's returns of holdings of one acre or more). No official estimates of the yield of early potatoes are available for the past season. Planting was delayed this year, owing to weather conditions in the spring, which caused the home crop to be somewhat backward. Home supplies, however, exceeded expectations in June, and, with a steady demand, price fluctuations were less pronounced than in former years.

Imported Supplies. Imports of early potatoes from the Irish Free State and foreign countries were regulated under the Potato (Import Regulation) Order, 1934, as in previous seasons. The quota for February-May, 1937, was fixed at 72,000 tons, while for the period June-August imports were limited to 30,000 tons, of which not more than 25,000 tons were to be imported in June. Total imports under licence during the whole season amounted to 59,200 tons, as compared with 104,500 tons in 1936.

Imports from the Channel Islands, which showed a considerable decrease in 1936, again declined this season, unfavourable weather and a smaller acreage accounting for the fall in shipments.

Imports from the Irish Free State and foreign countries declined heavily, and total imports for the season were some 26 per cent. less than in 1936.

Imports from all sources from February to August in 1935, 1936 and 1937 were as follows:—

	1935 Tons	1936 Tons	1937 Tons
Irish Free State and Foreign Countries	90,400	104,500	59,200
Channel Islands	84,900	60,200	58,200
Other Empire Countries	1,300	1,700	5,800
Total	176,600	166,400	123,200

The Channel Islands' share of our total imports was 47 per cent. this season, compared with 36 per cent. in 1936, but there was a marked decline in the proportion supplied by Spain

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and the Canaries, which fell from 59 per cent. in 1936 to 32 per cent. in the past season. The reduction in Spanish imports is attributable to lateness of cropping in addition to the obvious difficulties of shipment.

PRICES: Prices of Spanish potatoes were considerably higher than in 1936; the seasonal average wholesale price per hundredweight showed an advance of 4s. over that of the previous season.

Prices of the Jersey crop, which at first were at a higher level than in 1936, declined later and the average price for the month of June was lower than that recorded for June, 1936.

Prices of home-grown earlies were at about the same average level as in 1936.

The following table shows the seasonal average wholesale prices per hundredweight of first and second quality new potatoes at large town markets in the past three seasons:—

<i>Variety</i>	1935		1936		1937	
	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>
Jersey (average prices in June)	19	3	21	0	18	9
Spanish	20	0	19	0	23	0 (Mataro)
English:						
Duke of York	8	2	7	7	7	7
Epicure	6	2	5	9	5	11
Sharpe's Express	9	0	6	9	6	10

Hops Marketing Scheme. Valuation of the 1937 crop was completed by November 26, and trading began on November 29, more than a month earlier than last year. During the first 28 days' trading, hops may be offered and sold only to merchants nominated by brewers who have entered into firm contracts with the Hops Marketing Board.

The Board have made a further payment to growers, which, with the previous advance of £5 per pocket (1½ cwt.), represents approximately two-thirds of the value of their quota hops.

Wheat Act, 1932: Sales of Home-grown Wheat—Cereal Year, 1937-8. Certificates lodged with the Wheat Commission by registered growers during the period August 1 to December 3, 1937, cover sales of 9,855,567 cwt. of millable wheat as compared with 9,142,966½ cwt. in the corresponding period (to December 4) in the last cereal year.

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Sugar Industry (Reorganization) Act, 1936. *Determination of Acreage for 1938 Crop.* The Sugar Commission is required by Section 5(1) of the Sugar Industry (Reorganization) Act, 1936, to determine for each year a maximum acreage in respect of which contracts may be entered into by the British Sugar Corporation, Ltd., with the object of ensuring that the quantity of sugar produced by the Corporation in each year from home-grown beet is as nearly as may be equal to 560,000 tons of white sugar. The Commission has accordingly fixed a maximum of 405,000 acres for contracts in respect of the 1938 beet crop. This figure has been sub-divided as follows:—English factories, 390,000 acres; Cupar (Scotland) factory, 15,000 acres.

Production of Home-Grown Beet Sugar during 1937-38 Campaign. According to information furnished by the British Sugar Corporation, Ltd., the total quantities of beet sugar manufactured in Great Britain during November, 1937, and the corresponding month in 1936, were:—

				<i>White cwt.</i>	<i>Raw cwt.</i>	<i>Total cwt.</i>
1937	..	..	..	1,505,179	1,917,068	3,422,247
1936	..	..	..	1,712,794	1,698,168	3,410,962

The total quantities of sugar produced to the end of November in each of the two manufacturing campaigns were:—

				<i>White cwt.</i>	<i>Raw cwt.</i>	<i>Total cwt.</i>
1937-38	..	..		2,350,821	2,918,650	5,269,471
1936-37	..	..		3,135,017	2,857,866	5,992,883

National Mark Fruit Products Scheme. The extension of the National Mark Fruit Products Scheme in 1937 to Fruit Juices, Fruit Concentrates and Aerated Fruit Beverages, in addition to the Fruit Juice Syrups Grades introduced last year, has made it possible to assess more clearly the problems that will have to be solved before any considerable demand can be established.

As regards fruit juice syrups, both the domestic and milk bar outlets have so far proved disappointing. An important point in this connexion is to discover the price level at which the demand can be improved, and also how lower price levels can be achieved without abandoning high standards

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of quality. On the other hand, the introduction of fruit juice syrups led to the discovery of a demand from other manufacturers (e.g., ice-cream makers) for fruit products of guaranteed genuineness.

As to aerated fruit beverages, the National Union of Mineral Water Manufacturers have shown an earnest desire to develop the trade, but, here again, the major point awaiting discovery is the price at which the public will become enthusiastic buyers.

Fruit concentrate products are expected to appeal particularly to manufacturers who require a fruit product, of undoubted genuineness, in convenient form.

The continual development of production technique gives hope that fruit juices, such as apple juice, will eventually become available at prices that, having regard to their superior value, will lead to a big demand. Many of these fruit products possess "sales points" that await full exploitation. For example, black currant juice is the richest known natural source of vitamin C. In Holland attempts are being made to encourage the use of Vitamin C made from temperate fruit products for therapeutic purposes; in the past the products usually recommended were from oranges or lemons. It should be wholly unnecessary for those interested in the therapeutic use of fruit products to rely on imported materials in the future.

It is believed that the fructose sugars contained in fruit are very readily assimilated for energy purposes, i.e., they provide the stimulation given by alcohol without any accompanying intoxication.

The establishment of a large trade in English fruit products is not going to be easy, particularly because citrus and alcoholic beverages have a very long start in public esteem. It is also becoming more and more difficult to introduce new products without very large advertising appropriation. Even with these difficulties in mind, however, the merits of the product justify a faith that will be fruitful to the extent that development is pushed with energy and good sense.

Livestock Industry Act, 1937. *Cattle Fund.* The following table gives particulars of payments made out of the fund set up under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936, and the Livestock Industry Act, 1937:—

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<i>Period</i>	<i>Payments</i>	<i>Animals</i>	<i>Average Payment per Animal</i>		
	£		£	s.	d.
April to November, 1935..	2,517,813	1,067,318	2	7	2
April to November, 1936..	2,600,930	1,117,405	2	6	7
April to November, 1937*	2,537,742	1,064,879	2	7	8
From commencement of subsidy payments to November 30, 1937 ..	12,417,244	5,232,484	2	7	6

* The payments during this period comprised £1,357,952 for 581,742 animals certified under the Emergency Provisions Acts, and £589,003 for 186,390 animals of quality standard, and £590,787 for 296,747 animals of ordinary standard certified under the 1937 Act.

Livestock Advisory Committee. *Appointment of Welsh Sub-Committee.* In the December, 1937, issue of this JOURNAL (pp. 833-835) reference was made to the constitution under the Livestock Industry Act of a Livestock Advisory Committee, with Sub-Committees for England and Scotland, for the purpose of giving advice and assistance to the Livestock Commission in the discharge of their functions. It was stated that the Welsh Sub-Committee would be constituted shortly.

The Minister of Agriculture and Fisheries has now appointed the following to be members of the Welsh Sub-Committee:—

R. N. Jones, Esq. (Chairman).
 A. Cassin, Esq.
 R. Duncalfe, Esq.
 Professor J. T. Share Jones, M.D. (V.h.c.), D.V.Sc., M.Sc.,
 F.R.C.V.S.
 D. Lewis, Esq.
 F. A. Lloyd, Esq., F.A.I.
 J. T. Richards, Esq.
 Alderman W. Thomas, J.P.
 T. Williams, Esq.

Under the Livestock Industry Act any matter falling to be considered by the Livestock Advisory Committee that arises in relation to Wales only will stand referred to the Welsh Sub-Committee for consideration and the submission of a report to the main Committee.

Additional Members of Main Committee. The Minister of Agriculture and Fisheries, the Secretary of State for Scotland and the Secretary of State for the Home Department have appointed the following to be additional members of the Livestock Advisory Committee:—

D. M. Brown, Esq.
 Alderman W. Thomas, J.P.

JANUARY ON THE FARM.

R. W. WHELDON, D.Sc.,
King's College, Newcastle-upon-Tyne.

Although the farmer's calendar seldom begins its year in the present month, yet it is a time to consider prospects. Hopes and fears may alternate, but generally speaking the farming community accepts conditions with a calm optimism. It is well it is so, as there are elements of speculation and many determining circumstances outside the control of the farmer.

The past year closed with some disappointing features. For the milk producer, dairy stock and feeding stuffs are high in price. Flockmasters find the mutton trade not too remunerative owing to the high autumn values of sheep, and foot-and-mouth disease has caused a great deal of concern to the stockman generally.

Many farmers have lost the whole of their stock on account of the slaughter policy adopted by the Ministry. The losses in terms of £ s. d. appear high, but are in fact very small compared with the loss that would follow a general spread of the disease. In countries where the slaughter policy is not adopted, often because it would not be effective, the reduced efficiency of the live stock is a very serious item.

On the other hand, autumn cultivations were well advanced and we begin the New Year 1938 with cultural work well forward on most farms. Winter wheat on the whole appears to be looking well, and with moderately good weather until sowing time, a good seedbed for spring-sown crops should be readily obtained. The difficulty experienced last spring in this respect is still fresh in the minds of arable farmers, as well as the adverse effect of bad cultural conditions on the resultant crop.

Seed Rates, Seedbed, and Varieties. A first essential to a good crop is to obtain "a plant," while a second important factor is the number of plants, or the "thick-ness" of the crop. Cultural conditions play a most important part as affecting germination and plant establishment, while the need for good seed of high germination, producing vigorous seedlings, cannot be over emphasized.

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With cereals, size of grain and tillering properties must be taken into account. At Cockle Park, 3 bus. of sandy oats gave a thicker crop than 6 bus. of yielder oats, owing to the greater grain and greater tillering powers of the former. Tillering properties are a great advantage where there is a risk of damage by wireworm or leather-jackets, as there is a prospect of the crop filling in even if a considerable percentage of the young plants has been destroyed. Non-tillering varieties remain a thin plant with corresponding loss of crop.

Barley as a winter-sown cereal is increasing in popularity in many districts. Some excellent malting samples are grown from winter-sown crops, but as barley frequently follows roots there is a limit to the area that can be sown in the autumn. Where spring sowing is practised there is no doubt great advantage in sowing early, to allow a long growing season in order to obtain mature grain. It should be borne in mind, however, that of all the cereal crops barley is most insistent on good cultural conditions. It is better to wait until a good seedbed can be obtained than risk a less satisfactory one, simply to get the crop sown. It usually pays to wait until the conditions are right, as good soil conditions not only affect the early stages of growth of the plant, but the whole growing period.

At Cockle Park the effect of cultivation on soil conditions of temperature and moisture has been compared on two plots for many years. One plot is kept well cultivated and a surface mulch maintained to a depth of 3 in., while the other is not tilled but kept clear of weeds. It is found from soil thermometers that the temperature on the cultivated plot is much more uniform at a depth of 12 in. than on the uncultivated plot. There is frequently a variation of 4°C. more on the latter plot between day and night temperature, while during dry weather the rate of loss of soil moisture is much greater on the uncultivated plot. Both these factors have an important effect on plant growth.

By careful observation or weighing, information can be obtained as to the most suitable seed rate for a particular soil in any district. At Cockle Park it is found that 3½ to 4 bus. of barley give the biggest crop, while on the more kindly soil of Tweedside less than 3 bus. will give a full plant.

No implement produces a mulch as fine as that obtained after land has been exposed to frost. During the

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present month, no opportunity should be lost in pushing forward with ploughing so as to get the benefit of any frosty spell that may occur.

Land Fertility Scheme. Reports from many sources indicate that merchants are fully booked up for a considerable time for both basic slag and lime. Farmers have not been slow to take advantage of the facilities offered to obtain supplies of these fertilizers on favourable terms. It is most important, however, to bear in mind that economic returns are most likely to be obtained when these fertilizers are applied to soil where they are needed, and other necessary conditions fulfilled. This is especially so with grass land. Much experimental work in the North of England indicates that even although chemical analysis may show a lime requirement on grass land no economic return is obtained from its application. Even where a good response is obtained on pasture land from either lime or phosphates it is necessary to increase the grazing stock in keeping with the increased output of grass, otherwise much of the increase is wasted. Much of our grass land is already understocked and the expenditure of money on manures even at low cost on this type of land cannot possibly leave an economic return without the provision of sufficient grazing stock.

It is encouraging to find that farmers are making good use of the facilities offered by County Agricultural Staffs and Advisory Officers for soil analysis. Unless farmers have had previous experience of the result obtained on their particular farms from lime and basic slag it is most desirable that they should seek guidance from the County Organizers as to the interpretation of the chemical analysis, and the type and quantity of fertilizer to apply. Although much experimental work has been carried out and much valuable knowledge accumulated there is still need for further work in connexion with the manuring of grass land, especially with regard to the different types of basic slag for different soil conditions.

All experienced graziers must know that it is not easy to assess the value of a pasture merely from observation. At Cockle Park farmers have frequently chosen plots as being the best when accurate returns of live weight increase have shown that other plots were better. While much can be judged from careful observation it is safer to check by measurement whenever possible.

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Livestock. January is not characterized by any major feature in livestock management, except that on many low-land farms lambing will commence. This is chiefly amongst Down breeds, and on farms where suitable feed for the nursing ewes can be provided.

The major fat stock shows during the past month have again reminded us of the large number of breeds of cattle, sheep and pigs, which we maintain in such a small country, and the question whether all are really necessary might rightly be asked. No doubt much may be said in favour of a reduction in the number of separate breeds, especially of pigs, but a more important question for the individual is perhaps "have I the breed or class of animal best suited to my circumstances?" There are perhaps three main considerations that effect the returns from livestock operations: (1) Conditions as affecting climate and quality and nature of food available; (2) the type of animal used for the conversion of food produced, and its efficiency; and (3) the market demand and the price obtained for the product. By manuring, cultivation, etc., the farmer may, to some extent, alter the character of the first of these, while the market demand may also be modified somewhat, but the choice of breed and type of animal is more within the farmer's control, and this is of course an important matter as affecting returns.

As to sheep stocks, the need for keeping animals suited to the particular conditions is very well recognized. The large Down and Long Wool Breeds would make poor use of hill pasture, and as regards much of our poorer sheep grazings, the most important factor is that the breed or cross should give the best possible return for the class of food available. Breeders can alter and have altered the characteristics of the animals they produce. During the past thirty years the great object seems to have been to obtain "quality." Early maturity, good feeding properties and breed type have been stressed and in a large measure obtained. Increased variety and quantity of available concentrated foods have been a valuable help in obtaining greater live weight gain and early maturity. It should, however, be borne in mind that there are large areas of land of relatively low productivity and that produce food that has not high feeding value; for this class of land the great need is for animals that will make good use of the farm roughages without undue dependence on purchased concentrates. Generally, the poorer the type of food pro-

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duced on the farm the more difficult it is to obtain an economic return from purchased concentrated foods.

At the present time there seems to be a greater tendency for breeders to look for stock that are best suited to the local condition. In the North of England, the place of the Scotch Black-faced Sheep is being challenged by the Swaledale, which is said to be hardier and to make better growth than the Scotch type. During the last few years, many Swaledale rams have been purchased for Scotch Blackfaced flocks, and Swaledale ewes have in a number of instances replaced the Scotch ewe.

With cattle also farmers are obviously attempting to determine the breed or cross most suitable. In Northumberland enterprising breeders and feeders are introducing various breeds and crosses for comparison with their present stocks. "Quality" is a very valuable characteristic, but constitution, weight for age, and ability to utilize home-grown foods must not be sacrificed.

AGRICULTURAL MACHINERY TOPICS

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Tractor Power in Ploughing. In a Conference paper read in January last the writer and one of his colleagues suggested that tractor users waste considerable sums of money annually through not loading their tractors efficiently. In expressing this opinion they had in mind, not the many light jobs in which it is difficult to load even a small tractor to capacity, but the heavier operations of autumn cultivation. Their argument was based on the dynamometer measurements made in the field on twenty tractors chosen at random, all of which were engaged in heavy cultivating operations on commercial farms. In only five instances was the power developed by a tractor as much as 80 per cent. of its rated drawbar h.p., while on average the tractors should have been capable of doing nearly 40 per cent. more work than they actually were doing in a given time. If there was any weak point in this argument it lay in the fact that at the time very little evidence was available in support of the assumption that the standard rating (i.e., 75 per cent. of the maximum drawbar h.p. developed in an official test) did in fact represent a measure of what a given tractor should be able to accomplish under practical conditions. Further evidence on this point, however, is now available in the recently published reports on the first series of tests under the R.A.S.E. Tractor Testing Scheme*, for several of the ten tractors concerned had already undergone more formal engineering tests at Nebraska, U.S.A.

Comparison between the results recorded at Nebraska and in the R.A.S.E. ploughing tests respectively shows clearly that tractors in general should be able to develop at least their full rated power under ordinary farm conditions—provided only that their users load them properly. Unfortunately, however, this conclusion as it stands is not of much direct value to farmers because they rarely have means at their disposal for measuring either the power developed by their tractors or the power required by their implements. Of more

* See p. 1029.

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immediate interest, therefore, are the figures given in the R.A.S.E. reports for the rates of ploughing accomplished by the various tractors under two different sets of conditions: heavy land with a mean resistance of 14 lb. per sq. in. of furrow section over a ploughing depth of 5.5 in.; and light land with a resistance of 7.5 lb. per sq. in. over a depth of 5 in. Making no allowance for time lost in turning, or in stoppages other than those necessary for making the measurements, the ten tractors ploughed an average of 0.044 acres per hour of the heavy land, and 0.083 acres per hour of the light land for each h.p. developed. Some indication of what these figures mean in ordinary terms is given in the following Table, in which an attempt has been made to set down, on the basis of the above test results, the rates of ploughing that different classes of tractors ought to accomplish on different types of land.

Type of Land	Ploughing Resistance : lb. per sq. in.	Acres per hour Ploughed by Different Types of Tractor (ploughing depth 5-6 in.)			
		" Baby " Row- crop Tractors 9-12 h.p.	Small Wheel Tractors 14-17 h.p.	Medium Track- laying Tractors 18-20 h.p.	Large Wheel Tractors 24-28 h.p.
Very light (3 horses to 2 furrows) . .	4 to 6	1.12-1.49	1.74-2.11	2.23-2.48	2.98-3.47
Light (2 horse)	7 to 9	0.70-0.93	1.08-1.32	1.40-1.55	1.86-2.17
Medium (2-3 horse)	10 to 12	0.51-0.68	0.79-0.96	1.02-1.13	1.35-1.58
Heavy (3-4 horse)	13 to 16	0.39-0.51	0.60-0.73	0.77-0.86	1.03-1.20
Very heavy (4-5 horse)	17 to 20	0.30-0.40	0.47-0.57	0.60-0.67	0.80-0.94

The above tentative classification of different types of land has been based on local knowledge of horse-ploughing practice on the land used for the R.A.S.E. tests, and on the fact that measurements of ploughing resistance made from time to time by the writer and his colleagues indicate extreme limits for this country of rather under 5 lb. per sq. in. on a light sandy soil on which two-furrow horse ploughs are commonly used and rather over 20 lb. per sq. in. on a Worcestershire clay baked hard by a dry summer.

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By 3-4 horse land is meant land on which three horses would be used for ordinary stubble ploughing but on which four would be needed for ploughing out a clover ley or for hard-baked stubbles.

The writer has yet to hear of a farm on which anything like these hypothetical ploughing rates are achieved in practice, but so many questions are involved in comparisons between theory and practice that further discussion of the subject must be postponed for a future occasion.

Lime and Chalk Grinding. The Land Fertility Scheme, 1937, has caused a renewed interest in lime and chalk grinding, and information about machines for the purpose is therefore of value. Practically all the smaller machines, i.e., those that are suitable for farm or estate use, work on the hammer-mill principle, in which the material is beaten through steel screens by hammers swinging from a fast moving rotor. Such machines vary in power requirement from 6 to 25 h.p.; in output from 5 to 30 cwt. per hour, and in cost from £100 to £300. Comparable figures for different machines are, however, very difficult to obtain, because both power requirement and output will vary enormously with the type of material to be ground and the fineness of the final product. The three materials ordinarily available for grinding are limestone, burnt limestone and chalk, and of these burnt limestone is by far the easiest to handle. Chalk is not difficult to grind when it is dry, but, except perhaps in a dry summer, the chalk as dug is likely to be too wet to pass through the machine. It can be dried on a drying floor or by stacking under cover for some months. Unburnt limestone is much harder than either of the other materials, and by no means all the machines on the market are strong enough to deal with it at all. Unless direct information to the contrary is given, it should be assumed that the output figures quoted by the makers refer to burnt limestone, and that the output with fresh-dug material will be at most half as much.

Fineness of grinding in a machine of the swinging hammer type is controlled entirely by the size of screens fitted. The size generally considered suitable for agricultural purposes will contain about 10 meshes to the inch; and this should produce a material of which only from 10 to 15 per cent. is too coarse to be immediately available.

Relatively little lime or chalk grinding has been done on

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farms during the last few years, and makers are consequently rather out of touch with agricultural conditions and requirements. Most of them, however, will be prepared to carry out a grinding test on material supplied to them by prospective purchasers, and it is suggested that exact information should always be obtained in this way before a decision is made.

Implements at Smithfield. In spite of the obvious limitations of space the Smithfield Show continues to provide one of our most important implement exhibitions, mainly because it is held at a time when both dealers and farmers have some leisure to consider their future requirements. Nowadays each successive show includes a wider range of tractor equipments, and a notable feature last month was the modern tendency to equip tractors with directly-attached cultivator units, most of which were provided with some form of power lift. These units cover not only row-crop equipment proper, but also rigid cultivators and similar appliances for ordinary arable work. One advantage of close-coupled implements is that some of the downward soil reaction is transferred to the drive wheels or tracks of the power unit and so tends to improve adhesion. Another advantage is that, particularly when a power lift is fitted, the outfit is more easily manoeuvred and a considerable saving in turning time is effected. The same close-coupling tendency is to be observed with 2-wheeled market-garden tractors, although it is doubtful whether in such instances the resulting transfer of weight is always to the benefit of adhesion. This is because the torque-reaction of the drive wheels of any vehicle tends to transfer weight from the front to the rear, and the shorter the wheel base the more weight is so transferred.

Another line of development in tractor equipment is the provision of haymaking appliances wide enough to deal satisfactorily with the 6- or 7-ft. swath left by a power mower. Up to the present, haymaking behind wide cut mowers has involved makeshift arrangements of ordinary equipment which, particularly in a difficult season, have not been very satisfactory. Incidentally, it has not been a very easy problem for the implement maker to provide this equipment. All the complicated motions necessary to deal with the older 4-ft. 6-in. swath were worked out so long ago that the very fact that they are complicated has probably

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been forgotten; and the design of wider equipment has involved much more than a mere increase in width.

Finally, among machinery exhibits of special interest there may be mentioned the ever-widening range of baling appliances. Interest in baling is increasing for two reasons: (1) because grass-drying propaganda has made farmers in general more conscious of the seriousness of haymaking losses; and (2) because users of combine harvesters are becoming less and less inclined to sacrifice their straw. The research side of hay baling in the field is by no means complete, and nothing like a foolproof technique applicable to all conditions has yet been worked out. Yet it is clear that field baling works in very well with the use of high speed motor or tractor sweeps, and also that, in some instances at any rate, it gives rise to a higher-grade product. As so often happens in modern agriculture, farmers have got ahead of research, and in increasing numbers are working out the details of hay baling for themselves. Opinions differ, sometimes from one locality to another, about the relative merits of tightly packed "wired" bales and the looser packed bundles tied with twine. This year a third possibility is likely to arise through the introduction of a machine that makes a self-tying wire-bound bale that will probably be intermediate between bales produced by the other two types.

Up to the present the cost of collecting straw behind a combine has been rather more than the straw itself is worth, and most combine users have left it to be ploughed in or burnt. However, the straw adds considerably to the difficulties of autumn ploughing, and is a worse nuisance than ever when the corn has been undersown with seeds. A consequence of this is that only a small rise in the value of straw is necessary to start a straw-collecting movement in which "pick-up" baling equipment figures prominently. Machines of both the self-tying and the ram-baler type are available: the latter having obvious advantages when the straw is intended for sale off the farm.

NOTES ON MANURING

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Mineral Phosphate. Farmers who have been unable to obtain their full requirements of basic slag must very soon decide what they are going to do about possible alternative supplies of phosphate for this season. Many of those whose decision to purchase slag arose primarily from a desire to improve their grass land under the Land Fertility Scheme may decide to wait until the requisite supplies of basic slag are obtainable even if this means waiting another year. After all, the Land Fertility Scheme is to remain in operation for *at least* three years, i.e., until July, 1940, and can be extended for two further years if necessary. On the other hand, the heavy demand for slag under this grassland improvement scheme will no doubt have left many regular users of slag with insufficient supplies for their normal requirements. Such farmers will have to choose between the purchase of some other type of phosphatic fertilizer and the withholding of phosphate from their 1938 crops. It is to be hoped that most farmers will look round for some suitable alternative source and that they will not omit phosphate from their fertilizer mixtures unless they have very good reason to believe that recent applications have left a good reserve in their soils.

(a) *On Arable.* The natural alternative to basic slag, especially on arable land, will usually be superphosphate, but the claims of ground mineral phosphate must not be entirely overlooked, and these call for even closer consideration when the phosphate is required for grass land.

Nearly a century ago Lawes experimented with mineral phosphate as a fertilizer but found it much less effective than superphosphate. The type of phosphate rock available to-day, however, is much purer and usually more finely ground than the material used by Lawes. Experiments during the last quarter of a century suggest that some crops have considerable power of utilizing the phosphate in finely-ground mineral phosphate, though soil and climatic conditions greatly affect its value as a fertilizer. Lucerne, lupins, peas and cruciferous crops such as mustard, turnips, swedes, cabbage and rape

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are said to have considerable power of utilizing mineral phosphate, but clover, potatoes, carrots, tomatoes and cereal crops such as wheat, oats, barley and rye can apparently make little or no direct use of this form of phosphate.

In general it is also found that mineral phosphate is less effective in the early stages of growth than is superphosphate. This point is of special importance where the phosphatic fertilizer is required for spring application on arable crops.

There has not been any extensive scheme of experiments on the use of ground mineral phosphate for arable crops in this country, presumably because a somewhat quicker-acting type of phosphate is generally preferred. The West of Scotland Agricultural College carried out some forty trials on swedes during the seasons 1926 to 1928, comparing ground mineral phosphate with superphosphate and other forms of phosphate. On the average of forty trials ground mineral phosphate gave a slightly lower yield than did superphosphate. Each form of phosphate supplied the same total amount of P_2O_5 as 6 cwt. per acre of superphosphate. The actual yields were as follows:—

<i>Fertilizer</i>	<i>Yield of Swedes per Acre</i>	
	<i>tons</i>	<i>cwt.</i>
Superphosphate	27	19
High-soluble Slag	26	10
Mineral Phosphate (120 mesh) ..	25	18
„ „ (100 mesh) ..	25	7

Hence on a crop that is said to have considerable power of utilizing mineral phosphate this form of phosphate did not prove quite as satisfactory as superphosphate though it was almost as good as basic slag. In general it is probably true to say that in dry districts or in dry seasons, and on soils well supplied with lime, ground mineral phosphate must be expected to act more slowly than superphosphate. In a moist climate and on a soil retentive of moisture but not well supplied with lime, ground mineral phosphate may prove satisfactory for those crops mentioned above as being able to make considerable use of this form of phosphate, but it seems doubtful whether its use for crops such as potatoes, sugar-beet or barley can be recommended in preference to superphosphate under the conditions in which these crops are usually grown.

Experiments by J. A. McMillan and the writer of these notes

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in the Cambridgeshire Fens did not justify its use in place of superphosphate for mangolds or sugar-beet on fen peats.

(b) *On Grass.* Though mineral phosphate is not as universally effective as high-soluble basic slag, there are conditions in which it will bring about considerable improvement of grass. Numerous experiments have been made on the hay crop comparing mineral phosphate with superphosphate and with high-soluble and low-soluble types of basic slag. Results from different centres have not always shown very close agreement, a fact that points to the influence of local conditions on the relative effectiveness of these fertilizers. Nevertheless, recent experiments conducted by Rothamsted provide definite information as to some of the conditions under which one may expect a response to mineral phosphate.

HAY EXPERIMENTS—AVERAGE OF FOUR YEARS*

	Actual Yield without Phosphate	Relative Yields (No phosphate = 100)				
		No Phosphate	Low-Sol Slag	Mineral Phosphate	High-Sol. Slag	Super-phosphate
<i>Neutral Soils</i>	<i>cwt p a</i>					
(1) Essex ..	19·4	100	109	105	132	128
(2) Gloucester	32·4	100	99	98	103	107
<i>Acid Soils</i>						
(3) Northumberland	6·2	100	134	194	171	181
(4) Yorkshire	15·7	100	121	135	142	142
(5) Derbyshire	31·3	100	109	114	113	120
(6) Shropshire	34·3	100	102	105	103	101

* Rothamsted Report for 1936

The mineral phosphate and low-soluble slag had little effect on yield of hay on the *neutral soils* even at the Essex centre, where the crop was less than 1 ton per acre and showed a marked response to other forms of phosphate. On *acid soils*, however, the mineral phosphate was much better than low-soluble slag, and on the average of the four years proved as effective as high-soluble slag or superphosphate, though in general superphosphate proved more effective in the first season. In order to obtain conditions more like those on a pasture field, two further experiments were included in the above series. The same phosphate applications were used, but the herbage was mown several times throughout each season, i.e., the produce was a succession of young grass crops

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instead of a hay crop. The relative effects of the different forms of phosphate were similar to those where the produce was cut for hay, and there is reason to believe therefore that the effect of mineral phosphate on a pasture will be comparable to its effect on the hay crop. In experiments just concluded on grass land on heavy clay soil on the Cambridge University Farm both superphosphate and high-soluble basic slag gave striking increases in yield whereas ground mineral phosphate was quite ineffective for 5 years after application. Here again the soil was *not acid*, and the result is in agreement with those obtained on neutral soils in the Rothamsted experiments.

The general position regarding the use of mineral phosphate seems to be that it is most likely to prove effective on certain types of acid soils, especially those of a heavy nature with a plentiful supply of moisture. It does not seem to do very well on fen peats and is rarely suitable for chalky soils or for light soils in districts of low rainfall, where it is usually less effective than either superphosphate or high-soluble basic slag. Even where it is as effective as superphosphate in the long run, it is rarely as quick acting, and so is less suitable where an immediate effect is desired, e.g., the encouragement of seedling growth.

Mineral phosphate, however, is a much cheaper source of phosphate than superphosphate or even basic slag and hence its use under suitable conditions of soil, crop and moisture supply is worth consideration. There are many districts in which conditions are not entirely favourable to its action either on grass or arable land, and before purchasing, therefore, inquiries should be made, e.g., from the County Agricultural Organizer, as to its suitability for the conditions in which it is proposed to use it.

Though reference has been made to its greater effectiveness on acid soils, there is of course a limit even on grass land to the degree of acidity at which it can be satisfactorily used. Observations at Cockle Park, Northumberland, suggest that where lime is applied in conjunction with mineral phosphate, the lime may retard the action of the phosphate. In such instances it may be best to allow some time to elapse between the application of these two materials, or, alternatively, use some other form of phosphate. On very acid fields liming will almost always be necessary, since no form of phosphate can fulfil the function of lime either in the soil or in plant nutrition.

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It must always be remembered that, for whatever crop the mineral phosphate is to be used, fineness of grinding is important. It is now often possible to get mineral phosphate ground more finely than the old standard of 80 per cent. passing through a 100-mesh sieve, at little extra cost, and there is reason to believe that this finer grinding may increase the effectiveness of the fertilizer.

Soil Organic Matter and Quicklime. In the *Jour. Roy. Agric. Soc.* for 1936, Sir John Russell drew attention to the unfortunate persistence of the old idea that quicklime or burnt lime destroys the organic matter in the soil. Judging by recent inquiries from many quarters this idea is very widespread and is still freely quoted. This is particularly unfortunate at the present time. When a national effort is being made to remedy the lime deficiency of our soils the greatest care should be taken, (1) to see that the assistance offered is not misused by the application of lime to land which will not benefit by it, and (2) to consider the merits of the various forms of lime only in the light of established fact.

The evidence usually quoted in support of the idea that burnt lime destroys soil organic matter whilst carbonate of lime does not was based on old-established Pennsylvanian experiments, as interpreted by Frear in 1899, and Hopkins in 1910. The evidence from these trials was re-examined, however, by other investigators who, in a report published in 1924, showed quite clearly that the interpretation of the evidence was wrong, largely owing to the accidental presence of charcoal on some of the plots. Not only was there no real evidence of any harmful effect from burnt lime, but both burnt lime and ground limestone were shown to have helped to conserve the organic matter content of the soil.

In 1921 there was more nitrogen and organic matter on the lime and limestone plots than on adjoining unlimed plots, despite the fact that in the 40 years 1881 to 1921, the lime plots received 40,000 lb. of burnt lime and the limestone plots 80,000 lb. of ground limestone per acre.

Sir John Russell states that "further evidence that burnt lime has no harmful effect on the nitrogen or organic matter content of the soil is afforded by the Woburn experiments. Unfortunately it is always difficult for a correction to catch up with a wrong statement." In this case 13 years has apparently not been long enough for the correction to catch up!

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended Dec. 8				
	Bristol	Hull	L'pool	London	Cost per Unit ¶
Nitrate of Soda (N. 15½%) ..	£ s. 8 0c	£ s. 8 0c	£ s. 8 0c	£ s. 8 0c	s. d. 10 4
" " Granulated (N. 10%) ..	8 0c	8 0c	8 0c	8 0c	10 0
Nitrate of Lime (N. 13%) ..	7 7e	7 7e	7 7e	7 7e	11 4
Nitro-Chalk (N. 15½%) ..	7 10c	7 10c	7 10c	7 10c	9 9
Sulphate of Ammonia :—					
Neutral (N. 20·6%) ..	7 9c	7 9c	7 9c	7 9c	7 3
Calcium Cyanamide (N 20·6%) ..	7 11d	7 11d	7 11d	7 11d	7 4
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 4	5 1	5 0	5 1	3 5
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%) ..	8 10	8 8	8 5	8 8	3 4
Sulphate " (Pot. 48%) ..	10 2	10 0	9 17	10 0	4 2
Basic Slag (P.A. 15½%) ..	2 12b	2 5b	—	2 10b	3 2
" " (P.A. 14%) ..	2 8b	2 0b	2 0b	2 6b	3 3
Grd. Rock Phosphate (P.A. 26— 27½%) ..	3 7a	3 2a	2 18a	2 12a	2 0
Superphosphate (S.P.A. 16%) ..	3 4	—	3 2f	3 0g	3 9
" " (S.P.A. 13½%) ..	3 1	2 17	2 19f	2 16g	4 1
Bone Meal (N 31%, P.A. 20½%) ..	—	7 5	7 5h	7 2	—
Steamed Bone Flour (N. ¼%, P.A. 27½-29½%) ..	5 5i	5 10	5 0h	4 15	—

Abbreviations : N. = Nitrogen ; P.A. = Phosphoric Acid ;
S.P.A. = Soluble Phosphoric Acid ; Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 5-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 5 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra and for lots of 4 cwt. and under 1 ton, 20s. extra.

e For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, for lots of 1 ton and under 2 tons, 7s. 6d. per ton extra, and for lots of under 1 ton, 20s. extra.

f Prices shown are f.o.r. Widnes.

g Prices shown are f.o.r. northern rails; southern rails, 1s. 3d. extra.

h Prices shown are f.o.r. Appley Bridge.

i Price shown is f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent. nitrogen, contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Protein Requirement of the Pig. In previous Notes (July, 1936, November, 1936), we discussed the influence of the protein supply in the food upon the growth-rate of the animal and upon the proportion of lean to fat in its carcass. With specific reference to the optimum protein supply for the pig we arrived at the conclusion that this was attained with the weaner if the ration contained 17-20 per cent. of protein, with a steadily decreasing proportion as the pig grows, reaching about 12 per cent. at 200 lb. liveweight. In support of these conclusions the careful feeding experiments carried out at Cambridge by Woodman and his colleagues were quoted. These have now been amplified to provide the one further item of evidence required to complete the proof, namely, that no additional storage of protein, beyond that discernible or measurable in terms of lean and fat, does actually take place in the pig's body when amounts of protein in excess of those indicated above are fed.

In the current issue of the *Journal of Agricultural Science* (Vol XXVII, p. 569) Woodman and his colleagues summarize the results of "balance experiments" with pigs of both sexes in which the intake and outgo of proteins and minerals on two different rations of widely-varying protein content have been determined at different stages of the pigs' development from weaning to slaughter. The protein content of the rations varied in the first stage (up to 90 lb. liveweight) from about 18 to 22 per cent., and in the last stage (over 150 lb. liveweight) from about 14-18 per cent. Despite these considerable differences in the protein supply there was practically no difference in the amounts of protein retained in the bodies of the pigs on the two levels of protein supply. Incidentally it may be noted that there was also no significant difference in the rates of liveweight increase, such little difference as was actually recorded being in favour of the lower protein supply.

Expressing protein in terms of nitrogen (protein $\div 6\frac{1}{2}$), the daily weight of nitrogen consumed in the different periods of the experiments, during which the average liveweights of the pigs

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rose from 48 lb. to 189 lb., ranged from 28.09 gms. to 101.70 gms., whilst the amounts of nitrogen retained in the body ranged only from 9.63 gms. to 16.61 gms. During a period of 60 days in which the results were strictly comparable the normal-protein pigs retained 841 gms. of nitrogen and the high-protein pigs 845 gms., although the latter had consumed 874 gms. of nitrogen (i.e., 5,463 gms. or 12½ lb., protein) more than the former. That this excess was largely broken up and its nitrogen excreted through the urine is indicated by the fact that the urine of the high-protein pigs contained 769 gms. more nitrogen than that from the normal-protein pigs.

Other items of interest from this report are (1) that young pigs digested their food as efficiently as at later stages of growth, (2) the extra protein in the high-protein rations had little or no effect upon digestibility, (3) the gilts showed a consistently higher rate of nitrogen (protein) storage than their brother hogs, even when the gilt received less protein than the hog with which it was compared (this confirms and explains the previous observations from practical feeding trials at Cambridge and elsewhere that gilts tend to give rather leaner carcasses than hogs); (4) the daily retention of nitrogen (protein) by the bacon pig remains very much the same throughout the whole period of growth from weaning to 200 lb. liveweight (and, therefore, the protein percentage in the food can be steadily reduced as the weight of food consumed increases); (5) the actual weights of protein, lime, and phosphoric acid required by the pig do not fall off appreciably during growth, and some supplement of lime is probably desirable even in the last stages of the feeding period.

Water Consumption by Suckling Sows. In the same issue of the *Journal of Agricultural Science* (p. 638), Garner and Sanders give an account of measurements made at Cambridge of the amounts of water consumed from drinking troughs by thirty-seven suckling sows of Large White breed tethered on grass pasture. The subject is one of obvious importance, on which, however, only scanty and conflicting data are available. The average of all the sows tested at Cambridge was about 43 lb. per day, but, as was to be expected, the variation between sows, and of particular sows from day to day, was very wide. The consumption was practically unaffected by

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weather, and was nearly the same in summer and winter. No relation could be traced between water consumption and number or weight of litter, but there seemed to be a tendency towards a slight decrease in water consumption after about the fourth week of lactation.

It must be remembered that in addition to the 43 lb. of water drunk the sows would also derive a certain amount of water from the grass consumed, and this might be roughly estimated at another 10 lb. daily for the summer, and 5 lb. for the winter period. A still further addition must be made for the water in the "dry" food, and that produced from the oxidation of fat in the sow's body during the suckling period. Making allowance for these minor supplies of water, Garner and Sanders arrive at a figure of 55 lb. as their estimate of the total daily water supply from all sources for the average sow. This would seem to fit in fairly well with the experience that animals of all kinds when free to take water *ad lib.* generally consume roughly 3-3½ lb. of water per 1 lb. of dry matter. An adult suckling sow fed entirely on meal foods will eat anything from 14 lb. upwards of meal, with an average of about 16 lb. At 16 lb. the expected water consumption on the above basis would thus be about 45-50 lb. or a trifle less if allowance be made for the water in the meal.

Protein Minimum for Laying Hens. In view of the trend of British experimental work in recent years to indicate that past estimates of the protein requirement of the laying hen have been rather exaggerated it is interesting to note that confirmatory evidence has been supplied by recently-published German experiments.

In the current number of *Archiv fuer Gefluegelkunde* (Vol. II, p.329) Fangauf and Haensel give an account of an experiment carried out at the Steenbek Poultry Experimental Station with four groups of Brown Leghorns on rations providing four different levels of protein supply. A fixed grain allowance of 25 grm. oats and 25 grm. wheat per head daily was given to each group, and 20 grm. per head of potatoes. Along with this a basal mash was supplied consisting of equal parts (by weight) of wheat bran, rye meal, dried sugar-beet slices, and rice meal. To this mash was added fish meal at the rate of 12 grm. per head daily for Group I, 10 grm. for Group 2, 8 grm. for Group 3, and 6 grm. for Group 4. On the basis of the average amount of mash eaten daily these amounts

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of fish meal represented 30 per cent., 25.2 per cent., 19.5 per cent. and 13.8 per cent. respectively of the mash. In comparing these proportions with those commonly used in British practice it must be noted that the basal mash to which the fish meal was added was much lower in protein than ours. The total daily supplies of digestible protein (taking basal mash at 40 grm. per day) worked out as follows:—

		<i>In Grain, Potatoes and Basal Mash</i>		<i>In Fish Meal</i>		<i>Total</i>	
		<i>gram.</i>		<i>gram.</i>		<i>gram.</i>	
Group 1	7.6	..	6.0	..	13.6
" 2	7.6	..	5.0	..	12.6
" 3	7.6	..	4.0	..	11.6
" 4	7.6	..	3.0	..	10.6

The birds were kept semi-intensively, with access to very good grass runs, but as the experiment ran from November to May the amount of food picked up outside was probably very small. On many days in the first five months the birds were entirely confined to the house by inclement weather.

The mash (dry) was always available in automatic feeders, and part of it given each morning made into wet mash with the 20 grm. of potatoes. The average mash consumption for the period of the experiment was practically the same for each group, ranging only from 39.6 grm. (Group 2) to 43.5 grm. (Group 4).

The average results in egg production for the period of 209 days from November 1, 1935, to May 31, 1936, are summarized below:—

	<i>Group 1</i>	<i>Group 2</i>	<i>Group 3</i>	<i>Group 4</i>
No. of eggs per bird ..	91.8	99.4	90.9	90.1
Average weight of egg, grm.	58.4	58.7	57.9	58.1
Total weight of eggs, grm. ..	5,361	5,833	5,220	5,279

It will be noted that, apart from Group 2, which for some reason can hardly have been quite comparable with the others, the results throughout the Groups are strikingly uniform. There was also practically no difference in the changes of average liveweight, which rose from start to finish by about 200-220 grm. in each Group. No mention is made in the report of any deaths in the Groups.

Hatching results from several hundred eggs from each Group gave average hatchabilities of 55.4, 67.5, 71.9 and 57.9 per cent. of fertile eggs in the four groups. The low value

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recorded for Group 1, as compared with Groups 2 and 3, is in accord with many previous observations of low hatchability where relatively high proportions of fish meal have been fed, but some other explanation must clearly be found for the similarly low value for the eggs from the fourth Group.

The results obtained in this experiment are in good agreement with those obtained by Macdonald at the National Institute of Poultry Husbandry in more precise measurements, to which reference has been previously made in these Notes (October, 1937, p. 689). In the latter an average daily supply of about 13 gm. of digestible protein—all of vegetable origin and therefore of comparatively low biological value—proved adequate to cover the needs of the birds for maintenance and relatively high production. With the mixture of vegetable and animal proteins used in the German experiments it is not surprising that an even lower level of protein supply should have proved adequate.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv
Wheat, British ..	£ 8 18	£ 0 9	£ 8 9	72	s. 2 4	d. 1.25	9.6
Barley, British Feeding	9 0	0 8	8 12	71	2 5	1.29	6.2
" Canadian No. 3							
Western	8 8	0 8	8 0	71	2 3	1.21	6.2
" Argentine ..	8 12	0 8	8 4	71	2 4	1.25	6.2
" Persian ..	8 3	0 8	7 15	71	2 2	1.16	6.2
" Russian ..	8 10	0 8	8 2	71	2 3	1.21	6.2
Oats, English, white ..	9 0	0 9	8 11	60	2 10	1.52	7.6
" " black and							
grey	8 13	0 9	8 4	60	2 9	1.47	7.6
" Scotch, white ..	9 13	0 9	9 4	60	3 1	1.65	7.6
" Canadian—							
No. 2 Western	10 3*	0 9	9 14	60	3 3	1.74	7.6
No. 3 Western	9 12†	0 9	9 3	60	3 1	1.65	7.6
Mixed feed ..	8 12	0 9	8 3	60	2 9	1.47	7.6
" Argentine ..	6 17*	0 9	6 8	60	2 2	1.16	7.6
Maize, Argentine ..	7 2	0 7	6 15	78	1 9	0.94	7.6
" Danubian ..	6 18†	0 7	6 11	78	1 8	0.89	7.6
" South African—							
No. 2 White	6 18†	0 7	6 11	78	1 8	0.89	7.6
No. 4 Yellow	6 18†	0 7	6 11	78	1 8	0.89	7.6
Beans, English, Winter	7 15	0 18	6 17	66	2 1	1.12	19.7
Peas, Japanese ..	21 0†	0 15	20 5	69	5 10	3.12	18.1
" English, blue ..	11 0	0 15	10 5	69	3 0	1.61	18.1
Milling Offals—							
Bran, British ..	8 2	0 17	7 5	43	3 4	1.79	9.9
" Broad ..	8 7	0 17	7 10	43	3 6	1.87	10.0
Middlings, fine,							
imported	8 10	0 13	7 17	69	2 3	1.21	12.1
Weatings† ..	8 10	0 15	7 15	56	2 9	1.47	10.7
" Superfine†	8 17	0 13	8 4	69	2 5	1.29	12.1
Pollards, imported	8 0	0 15	7 5	50	2 11	1.56	11.0
Mcal, barley ..	9 10	0 8	9 2	71	2 7	1.38	6.2
" " grade II	8 15	0 8	8 7	71	2 4	1.25	6.2
" maize ..	7 12	0 7	7 5	78	1 10	0.98	7.6
" " South African	7 5	0 7	6 18	78	1 9	0.94	7.6
" " germ ..	7 10	0 11	6 19	84	1 8	0.89	10.3
" locust bean ..	7 15	0 6	7 9	71	2 1	1.12	3.6
" bean ..	9 7	0 18	8 9	66	2 7	1.38	19.7
" fish (white) ..	15 0	2 5	12 15	59	4 4	2.32	53.0
" soya bean							
(extracted)†	9 12	1 11	8 1	64	2 6	1.34	38.3
Maize, cooked, flaked	8 0	0 7	7 13	84	1 10	0.98	9.2
Linseed cake—							
English, 12% oil ..	10 12	1 1	9 11	74	2 7	1.38	24.6
" 9% " ..	10 0	1 1	8 19	74	2 5	1.29	24.6
" 8% " ..	9 15	1 1	8 14	74	2 4	1.25	24.6
Cottonseed cake—							
English, Egyptian							
seed, 4½% oil ..	5 10	0 19	4 11	42	2 2	1.16	17.3

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Cottonseed cake, Egyptian 4½% oil ..	5 2	0 19	4 3	42	2 0	1·07	17·3
Cottonseed cake, decorticated, 7% oil	8 5†	1 9	6 16	68	2 0	1·07	34·7
Cottonseed meal, decorticated, 7% oil	8 5†	1 9	6 16	70	1 11	1·03	36·8
Coconut cake, 5% oil	7 12†	0 18	6 14	77	1 9	0·94	16·4
Ground nut cake, 6-7% oil	7 5*	0 19	6 6	57	2 3	1·21	27·3
Ground nut cake, decorticated 6-7% oil imported decorticated, 6-7% oil	9 2*	1 9	7 13	73	2 1	1 12	41·3
6-7% oil	7 15	1 9	6 6	73	1 9	0·94	41·3
Palm Kernel meal 1-2% oil	6 17	0 13	6 4	71	1 9	0·94	16·5
Feeding treacle ..	5 0	0 8	4 12	51	1 10	0·98	2·7
Brewers' grains, dried ale	6 7	0 11	5 16	48	2 5	1·29	12·5
Brewers' grains, dried porter	6 0	0 11	5 9	48	2 3	1·21	12·5
Dried sugar-beet pulp	From £5 2s. 6d. to £5 12s. 6d. per ton, ex-factory (according to factory).						

* At Bristol.

§ At Hull.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE: The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the beginning of December, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 1s. per ton as shown above, the cost of food value per ton is £9 19s. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1·43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 3d.; P₂O₅, 2s. 7d.; K₂O, 3s. 8d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6.2	8 8
Maize	78	7.6	7 2
Decorticated ground-nut cake	73	41.3	8 8
„ cotton-seed cake	68	34.7	8 5
(Add 10s. per ton, in each instance, for carriage.)			

The cost per unit starch equivalent works out at 2.16 shillings, and per unit protein equivalent 0.64 shilling. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent	Protein equivalent	Food Value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9.6	8 2
Oats	60	7.6	6 14
Barley	71	6.2	7 17
Potatoes	18	0.8	1 19
Swedes	7	0.7	0 16
Mangolds	7	0.4	0 15
Beans	66	19.7	7 15
Good meadow hay	37	4.6	4 3
Good oat straw	20	0.9	2 4
Good clover hay	38	7.0	4 7
Vetch and oat silage	13	1.6	1 9
Barley straw	23	0.7	2 10
Wheat straw	13	0.1	1 8
Bean straw	23	1.7	2 11

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, price 6d., post free 7d.

COUNCIL OF AGRICULTURE FOR ENGLAND

The 49th Meeting of the Council was held at the Middlesex Guildhall, Westminster, on Thursday, December 9, 1937, Mr. Robert Bruford, J.P. (Somerset), in the chair. The Minister of Agriculture, the Right Hon. W. S. Morrison, M.C., K.C., M.P., the Parliamentary Secretary, the Earl of Feversham, and the Permanent Secretary, Sir Donald Fergusson, K.C.B., attended on behalf of the Ministry.

Publicity. *Mr. T. C. Ward* (Salop) asked, on a point of order, whether it was the correct procedure for the Standing Committee's Reports to be sent to the London and Provincial Press for publicity before the meeting. The Chairman promised that the Standing Committee would consider the point.

Parliamentary Secretary's Address. *Lord Feversham* said that he came to the Council Meeting for the first time with some diffidence as an understudy. The Minister was engaged in piloting the Sea Fish Industry Bill through its committee stages and had asked him to take over until he could come to the Meeting. Speaking as a farmer himself, he did not need to be reminded of the value of the experience and wisdom of older hands in the industry, and he would attend very closely to the discussions on the various items on the Agenda which showed a scope comprehensive of the whole field of agriculture. The true significance of the Council was apparent when one considered that there were approximately 374,000 agricultural holdings in England and Wales, with 630,000 agricultural labourers and an annual output of agricultural produce of £208,000,000. The agricultural politician to-day had to exercise to the full the British genius for compromise. On the one hand, he had to deal with the farmers' natural desire for the largest share in the home market at the most remunerative prices, and, on the other, to consider urban consumers, who were far more numerous, and who were primarily interested in obtaining the largest possible supply of food at the lowest prices. Agricultural policy's main concern for the last few years had been the question of prices; in particular, the need to maintain steady prices rather than to allow violent fluctuations which pleased nobody. To meet that need, individual commodities had to be taken separately and one or other of the methods of

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tariffs, levies, quotas, and marketing schemes, or a combination of them, used as appeared to be best. He believed that by the use of those methods a large number of farmers had been rescued from the depression, and he hoped that, in the main, the emergency had passed. He did not suggest that no more remained to be done, but the point had been reached at which more permanent foundations could be laid. Some steps in that direction had been taken during the last Session of Parliament in regard to Sugar-beet, the Livestock Industry, and the Agriculture Act. The last-named Act reached to the land itself and would assist in improving the fertility of the soil. Drainage and the lime and slag scheme under that Act were subjects coming up on the Agenda through Reports of the Standing Committee. There were other items of considerable importance, and he would have very great pleasure in taking part where he could in the discussions.

Sir Arthur Hazlerigg expressed the pleasure of the Council in seeing Lord Feversham present, and moved a hearty vote of thanks to him for his interesting address, which was carried.

Lime and Basic Slag Subsidy Scheme. *Mr. Clement Smith* (East Suffolk) moved the adoption of the Standing Committee's Report (*see Appendix I.*). It was adopted without discussion.

Clearing of Watercourses. *Mr. R. L. Walker* (Yorks, W.R.) moved the adoption of the Standing Committee's Report (*see Appendix III.*). *Mr. A. Matthews* (Hereford) suggested that the period for approved schemes for grant under the Agriculture Act should be extended to the whole year and not limited as at present to the period October 15 to April 30. This was supported by *Mr. T. P. Gilbert* (Kesteven) and *Professor A. W. Ashby*, while *Mr. A. Pearce* said that it was both inhuman and false economy to confine the work to the winter months. He was sorry that the ditches were not left and the activity taken into the middle of the field. There was land to-day derelict because it wanted pipe draining; it could be done on land he knew at £17 an acre: a substantial grant towards that purpose would do much good. The cost made it prohibitive to many landlords and tenants at the present time. He suggested that the

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Report should be referred back to the Committee for reconsideration from that aspect.

Mr. George Dallas said there appeared to be misapprehension about the Report. It was mainly a summary of the existing law; not one of the proposals of the Standing Committee. There was a good deal to be said in favour of the work being done in the summer, but he had himself made representations to the Department on that point and had discussed it with those responsible. The strongest reason in favour of the present limited period was that agricultural labour was becoming increasingly scarce and to do large schemes of drainage in the summer would mean their execution at the very time when the farmer required the maximum amount of labour for farm work. He himself, however, thought there should be some elasticity in the time allowed.

Mr. John Beard said that, so far as the proposals were to give work to men who would otherwise be workless, it became, when given in the winter, a greater punishment. The job, he thought, should be done without any reference to the condition of employment in the country, and at the time of year when those who had to undertake it could best do it: that might be different in different localities.

Mr. R. L. Walker said he quite appreciated the points raised, but he would like the Report taken entirely apart from any question such as would be raised by an unemployment scheme. Any experienced man knew that there were times in winter when useful drainage work should be done. In the River Ouse Catchment Area, the Board of which he was Chairman, there were hundreds of men working all day on rivers and banks in winter, and his idea was that the Ministry would take a reasonable view where it was found impossible to finish a scheme in the given period. The Council would realize that there were many thousands of acres where pipe drainage was of no use at all. As a matter of fact, there were many fields where pipe drains that had ceased their functions would work again as soon as the open drains were cleared. It would thus often be found that it was not necessary to spend large sums on field drainage until the larger problem had been tackled and the drains cleared.

Mr. F. J. Jenkinson (Kesteven) said that in his county a great deal of drainage work for agricultural land was still required. They had been trying to formulate schemes and get them carried out on the 33½ per cent. basis, but his

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Council found it impossible to count on getting the money for their share of the cost. They were afraid that the cost would fall on the County Council. He thought it would be a great help if all grants were 50 per cent. He would be interested to know whether many schemes had been formulated and carried into effect on the 33½ per cent. basis. *Sir Donald Fergusson*, for the Ministry, said he could confirm what Mr. Dallas and Mr. Walker had indicated as to the reason for the grants; they were made in connexion with the improvement of the fertility and productivity of the soil, and not for the relief of unemployment. The Ministry had to consider the effect of such proposals on the ordinary employment on farms, and had framed the scheme of subsidies with conditions that caused as little interference as possible with ordinary farm operations. As regards the number of schemes, up to the end of November, 133 applications had been received, involving a total estimated cost of £184,000. He could not at the moment divide these figures into 50 per cent. grant applications and 33½ per cent. The Act allowed the grants to be given for three years, with a possibility of extension to five years. As regards field drainage, the Council would remember that the Minister, at the last Council Meeting, had expressed the view that the next logical step in giving assistance to drainage works would be arterial drainage, and that he had expressed the hope that the time would come when that matter could be further considered.

In reply to a question by a member as to whether it was a fact that not a single agricultural labourer would be employed at any time of the year in putting in new machinery, *Mr. Walker* said that many men were taken from the land for this purpose, to put in foundations and so forth. He was sure that the present scheme was on the right track, and he would only repeat that he knew the Ministry would be reasonable in the interpretation of the period.

The Report was put to the Meeting and adopted.

Rural Housing. *Mr. Dallas* moved the adoption of the Standing Committee's Report on Rural Housing (*see Appendix IV.*).

Mr. W. B. Pinching (Middx.) expressed the view that rural housing could not properly be dealt with by the Ministry of Health. Over and over again, Parliament had passed Acts and there had been subsidies and propositions for improving

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rural housing, and these had failed. People had been, and were being, driven off the land because of the shortage of houses. *Mr. Charles Roberts* (Cumb.) said he would emphasize one feature of the Report. He spoke as Chairman of a R.D.C. which were looking with great interest and with gratitude to the Bill that the Minister of Health proposed. They hoped it would give them houses to let to farm workers at not more than 4s. a week (including rates). They were clearing away small slum houses in rural districts just as much as in the towns, and they were dealing with overcrowding. They could not build a three-bedroomed house for less than £400, and taking in all the subsidies—the £2 10s., the £8 maximum, the £1 per house from the County Council and the £3 15s. as a maximum from the general district rate—and with a reasonable allowance for repairs and rates at 10s. or 11s., it was not possible for them to be built to replace slum clearance or overcrowding at less than 7s. or 7s. 6d. a week. One did not get any thanks for turning a man from an inferior slum house at a rent of 2s. 6d. or 3s. a week and offering him one at 7s. 6d. If R.D.C.'s rebuilt houses to replace slum houses or overcrowding, the cost would be 7s. 6d., but if they proceeded under the new Act, it would be 4s. There should be an additional subsidy for the former to bring them down to the latter figure.

Lord Hastings (Norfolk) referred to a proposal made to the Ministry of Health Sub-Committee by the Central Land Association, that the assistance which might be given to rural housing would be to permit agricultural holders to include in their maintenance claim for assessment of taxation, the cost of building new houses. Such a scheme would have the advantage of not being a standing charge on the Exchequer for any great length of time, and would not be in the nature of direct subsidy. The maintenance claim at present admitted allowances for reconditioning, but not for new houses. One objection to the proposal was that the higher the taxation that an individual paid, the larger would be the subsidy, but inasmuch as this would help only the surtax payer, the larger landowner who would be paying out of his pocket to build, that objection was not really a very serious one. Houses were required, and he thought that this suggestion should be considered. The Housing Sub-Committee had recommended the proposal to the appropriate Department for consideration, and he asked the

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Permanent Secretary of the Ministry to look into it, and, if desired, to press it on the Chancellor of the Exchequer with the aid of the Ministry of Health.

Mr. T. Lovell referred to the " tied " cottage attached to an isolated farm, and said he had been one of the victims of bad rural housing. As an agricultural worker, he had had sickness through ill-housing so that he had to take his wife and family out of the house with no ready alternative available. It was the isolated cottage that was neglected most because when the Councils built new cottages they considered only villages. *Mr. W. W. Sampson* (Dorset) congratulated the Standing Committee on its excellent Report, and, as Chairman of a R.D.C. with 36 parishes, where the proceeds of a 1d. rate were under £200, he wanted to see a guarantee that, if labourers' cottages were pulled down, others would be built for the purpose of housing purely agricultural workers. Some of these had had to offer up to 8s. 6d., including rates, out of their meagre wages, for cottages. He considered that even if isolated cottages were put into fairly habitable condition, the worker would not, to-day, get his wife to go and live in one of them. Cottages should be centred in the village, where there was some life, and buses going to town.

Mr. W. R. Smith considered this one of the most serious questions. He regretted any over-emphasis there might be on reconditioning rather than on new building. Many houses were not fit for reconditioning; there were no damp courses and an excessive amount had to be spent to put them in order. He agreed about the undesirability of isolated cottages, and the continuance of the " tied " cottage. The neglect of Local Authorities had been positively appalling. He called to mind one instance in Norfolk, where his own Chairman had deplored the fact that certain houses were tumbling down, and, if the people living in them did not vacate, they would shortly fall about their heads. He recently saw a R.D.C. with 36 villages in which only 14 houses had been built in one year, though there were 506 persons known to be living in 73 overcrowded dwellings, and where the maternal mortality was 6.72 per 1,000 against an average for the country of 3.65. The M.O.H. of Nottingham said that 90 out of every 100 houses were defective. He put it to the Council that the evidence showed that Local Authorities were not doing their duty in this matter. The

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amenity question in rural life was an increasingly important one, and unless it were attended to, labour would not be retained on the countryside. He advocated national control under a national authority, in the same way as animal diseases were to be nationally controlled.

Lord Cranworth (East Suffolk) did not agree with the last speaker that the reconditioning of cottages had been overdone. Where possible, they should be reconditioned and where there were no damp courses these should be put in. Moreover, the cost of building had risen very much; in his county it had gone up 30 per cent. He wondered whether it had been considered that the subsidy should on this account be increased. *Mr. T. C. Ward* said that if the grants had not been withdrawn in earlier years, there would have been more cottages available now. He held that the position of cottages now to be built was of first importance. In the past, sites had been used because they were on poor land, down old cartways and so forth. In future, the position would be of real importance, and the R.D.C.'s should have control, just as they have over water and sewage arrangements, and should say where houses shall be put: water should be in ample volume and easy of access. *Professor Ashby* supported the Report, and drew special attention to paragraph 8, which stressed the importance of the activity of R.D.C.'s. "Private enterprise" meant owners of land and anybody whose business it was to supply houses for farm workers, which naturally included agricultural workers themselves. If there were to be a development of private enterprise, the control should be under a recognized housing and sanitary authority. Professor Ashby then outlined certain special conditions which he thought necessary to apply to houses built or reconditioned by a subsidy to agricultural workers themselves, and which were subsequently let to persons other than agricultural workers. He added that no more cottages should be built by "private enterprise" for the running of a farm. The maximum number should be supplied with the best sanitation, access to amenities, etc., under public ownership. *Lady Mabel Smith* said that the inside of reconditioned houses ought to be at least as carefully considered as their outside appearance. There were hundreds or even thousands of rural cottages in England to-day where such things as good water and proper drainage were impossible. There was a form of overcrowding in rural houses which she would

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call "moral overcrowding," where growing children were forced to sleep in the same rooms as their parents. R.D.C.'s sometimes required a lot of moving, and in other instances where R.D.C.'s had been willing to get on with the work, they had been pulled back. She spoke also in favour of the extension of time from 5 to 10 years, and in favour of new houses rather than externally reconditioned ones. *Mr. C. H. Roberts* supported the remarks of Lord Cranworth as to reconditioning. Plans for reconditioning had to be got out and passed by the R.D.C. and the sanitary authorities, and there were hundreds of houses that could be reconditioned. It was far better to keep the old type of house than to build new ones.

Lord Feversham expressed the Department's sympathy with the great need for the improvement of rural housing conditions. He added that the Council would understand that, while details of proposed new legislation were under consideration by the Government, he could not discuss them in any authoritative kind of way. He would, however, assure the Council that their views would be conveyed to the Minister of Health, and further, that his Minister would no doubt wish to make special representations himself to the Minister of Health on certain points arising out of the discussion. He said also that it had always been a principle of the Housing Acts that all subsidies available to Local Authorities were available on equal terms to Housing Associations undertaking the erection of houses by arrangement with the Local Authorities.

Mr. George Dallas, in winding up the debate, said that the country had spent millions of pounds in subsidies for housing, to which the agricultural community, farmers, labourers and landlords had made their contributions; and the subsidies had gone largely to the urban section of the population. He believed in fair play for everybody, and it was now time that the rural districts should receive their share whilst the urban people paid. He promised that the Standing Committee would look into the point raised by Lord Hastings. That made by *Mr. Sampson* was also important, that whatever subsidies be given they should be substantial and ample, because it was no use trying to load a R.D.C. with a burden it could not carry. He thought it would be a great tragedy to extend the system of "tied" cottages. The point raised by *Mr. Walter Smith*, of national

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control, was, he thought, very important; it might be necessary to set up a national committee to see that the job was thoroughly carried out, and some compulsion might be necessary with the slower moving counties. The Report was put to the Meeting and agreed.

Transfer of Veterinary Functions. *Mr. C. H. Roberts* moved the adoption of the Standing Committee's Report on the proposed Transfer of certain Veterinary Functions from Local Authorities to the Ministry of Agriculture under the Agriculture Act, 1937.

Sir Merrik Burrell (West Sussex) moved the addition of an addendum as follows:—

The Standing Committee notes, however, that no mention is made in the proposals of the Ministry as to the transfer to the new National Veterinary organization of the Clerical Staff employed hitherto on veterinary work by the Local Authorities. Some of the members of such staffs have been employed for several years on this specialized work, and have become very expert in it, and the more specialized they have become the more difficult will it be for Local Authorities to absorb them into work of a different nature. Over and above the obvious unfairness and hardship caused by throwing these men out of work by a change of policy, it is quite certain that the new National Service will need their experience and expert knowledge if it is to function satisfactorily. The Standing Committee hopes, therefore, that the Minister will be able to assure the Council that this omission is only accidental in the draft proposals and not a real one.

He said that, as Chairman of the Agricultural Committee of the County Councils Association, he would be placed in a very difficult position if, when the arrangements were completed, it was found that certain of the Local Authorities' servants were going to have a hard deal. He hoped that "red tape" would not be allowed to cause difficulty. If the Council now added this paragraph, it might prove helpful to the Ministry in their task of making the arrangements.

Sir Arthur Hazlerigg seconded the proposal. *Mr. Roberts* advised the Council to accept it. *Sir Donald Fergusson* said it would not be fair to the Council to let it go out that the addendum was almost an agreed matter. There had been the most friendly collaboration between the Ministry and the Associations of Local Authorities over the very complex and difficult problem involved in taking over of the Veterinary Services. *Sir Merrik Burrell* and other gentlemen associated with him had given most valuable help. On this particular point of clerical staffs, the experience in Government Departments, and no doubt in Local Authorities' offices, was that

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clerical officers who had acquired proficiency in one branch would be very well qualified for clerical duties in another branch. In any event, the number of clerical officers involved was very small. In certain instances, it might be convenient to Local Authorities that an officer or officers should be taken over by the Ministry, but he did not think there should be any difficulty in Local Authorities absorbing them in their establishments in other activities. Apart from that, however, it was not a matter for one Government Department as it would be contrary to the policy of the Government to take over officers who could be absorbed in other ways. *Mr. W. R. Smith* said he hoped that the Ministry would not have too rigid a mind on this matter; there had been precedents where clerical and other help had been brought in from outside. *Sir Merrik Burrell's* addendum was then put to the Meeting, and added to the Report, which was carried unanimously.

Wheat Act Resolution. *Mr. W. J. Cumber* (Berks.) moved the adoption of the Standing Committee's Report on the Wheat Act Resolution referred to it from the last meeting of the Council (*see Appendix II.*). *Mr. H. W. Thomas* (Hants.) said he was disappointed that the Committee had not seen fit to recommend a higher standard price, as it was important to this country to produce more wheat; no one cropped to good farming more than wheat did. There were thousands of acres capable of growing wheat under certain conditions. *Mr. A. Symonds* (West Suffolk) proposed that the Report be referred back to the Committee on the grounds that the wheat crop should be increased. *Mr. R. F. Aubrey* (Hunts.) asked what encouragement agriculturists got from the Report. He referred to certain statements in it, adding that the Report failed to suggest that an economic return should be guaranteed to the producer. *Mr. W. W. Sampson* supported the reference back to the Committee, on the ground that more wheat would prevent a further increase of the subsidy in respect of milk. The 45s. was right for the time at which it was fixed, but everything had since gone up in price and wages were increasing; there would have to be a proper guaranteed price in time, with guaranteed wages, and a guarantee that the farmers' returns would be made full use of. Englishmen did not like control, but they would have to put up with it. *Lord Cranworth* stated that he moved in the

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House of Lords that the standard price of wheat should be increased to 55s. He thought that moderate when one considered that the standard price in France was the equivalent of 60s. He could, therefore, quite fairly support the reference back, but for the last sentence in the Report, which made it clear that the Standing Committee had in mind that the standard price should be examined by an expert committee with a view to alteration from time to time as associated conditions in the industry altered; with that he was satisfied. *Mr. John Beard* supported the reference back on the ground that the Wheat Act did not operate in an orthodox manner in fixing the price. The time had come for reconsideration of the basis on which a price of 45s. had been fixed. The farm worker has a right to a reasonable wage, and the farmer could only pay him that with guaranteed prices. The Ministry should be given the definite idea of the Council that there ought to be a revision of this standard price.

Lord Feversham said that in order to clarify the issue he would call attention to the fact that it had been made clear in the House of Commons and in the House of Lords that a policy of review of the standard price at stated intervals would be adopted by the Government.

Mr. C. W. Whatley (Wilts.) suggested that the difficulty would be met in the Report by adding words to the effect that the time was ripe for the question of a new price for wheat to be considered. *Mr. W. J. Cumber* then explained the Report in detail; and *Mr. R. L. Walker* reminded the Council that wheat had been grown, in the past, on lands that were not suitable. *Mr. C. H. Roberts* supported the Report and said that he hoped it would not be referred back, but that the Committee would adopt *Mr. Whatley's* addendum.

The Chairman put the amendment that the Report be referred back, which was lost: the addendum proposed by *Mr. Whatley* was then agreed for addition to the Report (see sentence in italics at end of Appendix II), and the Report as amended adopted.

Milk Distribution. *Professor A. W. Ashby* moved the adoption of the Report from the Standing Committee on the Food Council's Report on Costs and Profits of Retail Milk Distribution in Great Britain (see Appendix V.). *Mr. Charles Roberts* said that from the Food Council's Report one

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gathered that most profit was made by Co-operative Societies in the provinces—about 3*d.* a gallon. Distributors like the United Dairies made a profit of 4*d.* a gallon. The real difficulty was not excessive profits; it was excessive costs. The distributor's margin was 11.41*d.* and rationalization—cutting down wasteful methods of distribution, two deliveries a day and twenty dairymen going down one street—was necessary. Such things would have to be altered unless we were to have an established monopoly, as in Germany, which would raise an outcry that the small man was being injured and unemployment being caused. He would ask the Ministry to grapple with the problem. Would the Milk Board take over an experimental monopoly to see if they could get 3*d.* or 4*d.* a gallon off the costs? The Report was put to the Meeting and agreed.

Foot-and-Mouth Disease. *Sir Merrik Burrell* moved the following Resolution on behalf of the Standing Committee:—

That the Council of Agriculture for England desires again to support the Ministry in its policy of immediate slaughter of all affected and contact animals in outbreaks of foot-and-mouth disease as the only policy which, in the present state of knowledge, offers any reasonable hope of safeguarding this country against a calamity like that occurring at the present time in Europe.

He said that the Standing Committee had consistently supported the policy in past years and as there had been many letters and much irresponsible talk in the Press on the subject, the Committee's intention in reverting to the subject was to strengthen the Ministry's hands. What was the actual position? In this country there were comparatively few cases of disease, while in certain Continental countries it was very severe. In Belgium there were 10,498 outbreaks during October, in France 32,808, with a further 22,655 during the fortnight in November. During the same fortnight, Germany had had 1,952. The Netherlands had 11,444 during September, and Switzerland had 95 in the period September 1 to November 14. He thought he was right in saying that Switzerland had, at one time, a slaughter policy, but it had broken down. If H.M. Government threw over the slaughter policy, he thought our case would be worse than anything now happening on the Continent.

Mr. W. R. Smith seconded the motion, and said that while the Ministry was so efficient in managing this policy of slaughter, there would be no criticism that the Council need

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care about. *The Minister* (who had now arrived) said that, from the figures Sir Merrik had put before the Council, our country was clearly more fortunate than our Continental neighbours. He thanked the Council for the Resolution, as a body, without whose co-operation, the handling of these sort of problems would not have been possible. The Ministry relied on the willing co-operation of the agricultural community, and he had nothing but praise for the way in which the farmers had been vigilant and speedy in reporting cases of the disease. They had also put up in an uncomplaining fashion with the tedious restrictions which the policy necessarily involved. This was much appreciated by the Ministry. He was not going to say that we were out of the wood yet. The greatest vigilance should be continued, with a strict eye on sheep, and he asked farmers to report at once any suspicious illness in sheep. The Resolution was carried unanimously.

Proposed Ploughing-Up Subsidy. *Major Nelson Rooke* moved the following Resolution:—

That the Council of Agriculture for England requests the Minister of Agriculture to consider the extension of the Government's proposals for increasing the land fertility of the country by offering a contribution not exceeding, say, £1 per acre, towards the ploughing up and re-sowing of worn-out permanent pastures, subject to suitable conditions, such as inspection and approval by the County Authority, the use of specified seeds mixtures, and the establishment of a sound pasture.

He said that it was not necessary for him to explain the large range of pasture lands. Below the half-way line there was the worn-out pasture, and the average farmer to-day could not afford to start and re-sow this unless he had some help. The price levels in wheat and barley had risen so much that their subsidies were hardly being used at all. He thought some funds might be free for this other good work. *Mr. Clement Smith* seconded the Resolution, but suggested that it would be best to refer it to the Standing Committee for detailed consideration. The mover agreed, and the Resolution was referred accordingly.

Pigs and Bacon. *Captain W. C. Coates* (Leics.) moved the following Resolution:—

That the Council of Agriculture for England regrets that H.M. Government has failed to create the conditions under which farmers can make the production of bacon pigs pay.

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He said that the Resolution was put down partly owing to the delay in coming to a settlement, and also as a mild protest. The producer had done his bit in putting his house in order and it was then up to the middleman. The Minister had said that in 1936 the output of British bacon was double that of 1930 and that to-day we were producing one-third of the bacon consumed. He hoped that progress had really been made by the curers, who depended largely on the Government controlling imports, not only from the Dominions, but from foreign countries. In 1934, the Dominion of Canada exceeded her own quota from March to August by 134,000 cwt. In January, 1935, there had been the Government's statement as to the need for a subsidy, but nothing happened until March of this year, when the Pigs Marketing Board came to the decision that the subsidy could only be brought into use by agreement with foreign countries regarding the bacon being sent in by those countries. *Sir Arthur Hazlerigg* seconded the motion. The *Minister*, in reply, said that he knew pig producers would like to hear a statement of policy at the earliest possible moment. The difficulty arose from the breakdown of the contract system last year. No doubt one cause was the rise in the price of feeding stuffs, and the uncertainty in the minds of producers as to what the figures might be some months afterwards. The question of rationalization now being gone into with the curers was a difficult and complicated one. Negotiations had been going on since September and he was in a position to say that they had gone on very satisfactorily as a whole. He hoped to be able to make a statement fairly soon. The Resolution was put to the Meeting and carried.

McCreagh Estate. *Mr. H. W. Thomas* (Hants.) moved the following Resolution:—

That the attention of the Council be called again to the question of the derelict land (consisting of about 3,000 acres) in Hampshire, and that the Ministry be asked that steps be taken to bring this land into cultivation and so absorb labour and increase the food supply of the community.

The position, he said, was desperate; the land, with attention, was capable of producing a great deal of food, and he wished to ask again whether there was any method available for doing something with it. *Mr. John Beard* seconded the motion. *Mr. Charles Roberts* suggested that the Land Settlement Association could take it over as an example of inferior

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but improvable land and put on it ordinary weekly wage labour until the farms were reconstructed and reconditioned, when the land could be let to smallholders. *Mr. George Dallas* said that it was impossible to exaggerate the serious statements made about the condition of this land, and he recommended that the Minister should see it. All were agreed that it was an intolerable scandal.

Sir Donald Fergusson, on behalf of the Ministry, said that the Minister was well aware of the condition of this land. He would not now discuss the reasons the Minister gave at the last meeting as to why it had not been found possible to deal with the matter under the Land (Utilisation) Act, or get it dealt with by the County Council for smallholdings or by the Commissioner for Special Areas for land settlement. He still hoped it might be possible to find some way, and he would certainly have *Mr. Roberts's* suggestion considered. He would mention that litigation had recently occurred in regard to some of the land, and, when the award had been issued, it might be found that things not feasible now or in the past might be feasible in the future. The Resolution was put to the Meeting and carried.

APPENDIX I

Report from the Standing Committee on the subject of the Extension of the Period of the Subsidy Scheme for Lime and Basic Slag under the Agriculture Act, 1937

1. Farmers will be aware that the facilities which the Government have provided for the increased use of lime and basic slag on agricultural land will under the present powers be continued until July 31, 1940, i.e., until approximately three years from the date of the commencement of the scheme. The Agriculture Act, 1937, Part I of which embodies the scheme, makes possible an extension of it without further legislation for a further period of two years, but by means of two successive orders to be made when the periods are running out.

2. It would be a great advantage if farmers could be informed *now* that the scheme will be extended to cover a period of five years. The chief reasons as they appear to the Standing Committee are, first, the necessary loss of time before some farmers will be able to obtain supplies of lime or slag, and, second, that it is, in some cases, to be preferred that the lime or slag be applied in annual quantities in the course of the rotation of crops adopted on a particular farm.

3. As regards the first reason, it appears that the response of farmers to the scheme has been at the beginning so great as to tax severely the resources of existing lime-kilns and supplies of basic slag, and many applicants must perforce wait and take their turn as supplies become available; again, other farmers have found it necessary to look round before applying for lime or slag under the scheme and possibly to wait for advice from their Agricultural Research centre or Agricultural Organizer, because they want to know which particular fields should be treated and

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what quantities should be used having regard to the expenditure they themselves can afford. The delay so caused in applying lime or slag may mean that a large number of farmers requiring this assistance will not be able to get the commodity until next autumn or winter, so that one-half of the allowed period for the subsidy will by then have expired, leaving only another autumn and winter to complete any required dressings. A further consideration under this head is that the period of subsidy supply in the case of lime ought, in our view, to be sufficiently long to justify a lime producer in spending the capital necessary to work a new lime-kiln or to recondition one that has become derelict.

4. As regards the second reason, few mixed arable and pasture farms to-day are managed on a shorter than a four-course rotation, and if it is desired to deal with all the land of the farm fully and fairly, equal amounts of lime or basic slag should be applied each year during the rotation. Where this is desired and allowing for the fact that many farmers will not get their first year's lime or slag in the first year, it is suggested that five years from July 31, 1937, would be a more suitable period to allow farmers in which to complete their operations under this scheme.

November 19, 1937.

APPENDIX II

Report from Standing Committee on "Wheat Act" Resolution

1. At the last meeting of the Council of Agriculture the following resolution was referred to the Standing Committee for consideration and report:—

"That in the opinion of this Council there should be no limit to the amount of home-grown wheat entitled to the full deficiency payment and that the standard price should be raised to 50s. per quarter."

2. The Committee has considered this question and finds the present position to be that Parliament has now raised the amount of home-grown wheat entitled to the full deficiency payment from six million quarters to eight million quarters (see Section 13 of the Agriculture Act, 1937); and, as regards the standard price, that the Committee which was set up under the Wheat Act, 1932, to consider the desirability of making any alteration in the standard price, reported in June, 1935, that they saw no reason then to make an alteration, but recommended that authority be obtained for the subject to be considered again after a further period of years. The late Minister of Agriculture, Mr. Walter Elliot, in the course of a debate on agriculture in the House of Commons on July 31, 1935, said that "the Government . . . take note of the valuable suggestion, made in the report of that Committee [i.e. the Standard Price Committee], that further reviews should take place at stated intervals, instead of merely this review once and for all. I think it is clear that these reviews at intervals will be a feature of the policy which this Government, and, indeed, future Governments, will need to adopt with regard to agriculture." The Committee has noted that in the course of the debate in the House of Lords on July 22, 1937, on the committee stage of the Agriculture Bill the Parliamentary Secretary to the Ministry, Lord Feversham, stated that it was proposed shortly to bring forward a Bill to make certain amendments to the Wheat Act, that the Wheat Commission had suggested that provision should be made in the Bill for the setting up of a further committee to review the standard price at triennial intervals, and that this proposal was receiving consideration, together with the other proposals for the amendment of the Wheat Act.

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3. Turning to the general questions involved in an acceptance of the resolution, the Council will realize that the Standing Committee could not well undertake a consideration of the whole economic position of agriculture so as to enable it to say to what extent the wheat crop should be encouraged, having regard to the claims of other food crops for a share in our limited farm lands, and at what price it would be appropriate for the State to guarantee its sale in order to obtain the desired increased acreage. The Standing Committee is not persuaded that the increased production of wheat should be advocated rather than that of other food crops. It is true that there is inferior pastureland up and down the country which would be better ploughed up and sown with a suitable food crop and thus rendered more productive, though it is noted that for this class of land the Government have already brought in a scheme for the supply of cheap lime and basic slag so that it may continue as better pasture than formerly. The fact is that there are inducements enough to farmers for ploughing-up land for wheat or other crops, if they are persuaded that the land is better to them as arable than as pasture, and if they can get the consent of their landlords to ploughing-up without trouble and real expense. In addition, financial assistance, direct and indirect, towards greater production of food crops is being given by the Government, and the Standing Committee does not feel that it can fairly recommend that the wheat crop should be singled out for more assistance than is provided under the Wheat Act, 1932, and Part II of the Agriculture Act, 1937, providing arrangements are made—as it is understood they will be—for the “standard price” to be examined by an expert committee with a view to alteration from time to time as associated conditions in the industry may alter. *The Standing Committee hopes that the Committee in question will be set up as soon as possible.*

December 2, 1937.

APPENDIX III

Report from the Standing Committee on the Clearing of Watercourses

1. In connexion with the campaign to increase the fertility of the land by means of the larger use of such agents as lime and basic slag, the Standing Committee has had a variety of questions under consideration. That dealing with the desirability of an early announcement of the extension of the Subsidy Scheme for five years is dealt with in a separate report. The present report will deal with certain land drainage aspects, as efficient drainage is recognized as fundamental to fertility.

2. The Committee is glad to note that assistance is being given, under the Agriculture Act, 1937, to Drainage Authorities other than Catchment Boards, in finding money for the smaller works of arterial drainage. Grants are available at the fixed rate of 33½ per cent. for ordinary drain-clearing work, and 50 per cent. in the case of schemes, or portions of them, involving the provision of machinery or expensive material. All schemes as to which application for grant is proposed require the Ministry's approval in the first instance, and will be confined each year for three (and possibly for five) years to the period October 15 to April 30. It should be noted that for this purpose County Councils, and those County Borough Councils having agricultural committees, come within the category of Drainage Authority, and can organize voluntary schemes among landowners and farmers where a combined system of land drainage appears to be required. Field drainage is not included within the scope of these grants, but in certain counties sheep gripping or the cutting of

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sheep drains will rank for grant provided the scheme embraces more than one holding.

3. In addition to calling attention to these new powers, the Standing Committee desires to refer to the provisions of the Land Drainage Act, 1930, which requires occupiers to keep the smaller watercourses clear of obstruction, so that field drainage water from farmlands drained by such can get away into the main rivers, and so to the sea. Section 35 of that Act empowers Drainage Boards (other than Catchment Boards)—and Section 50 (2) gives the same power to County and County Borough Councils—to serve notices on those by whose act or default the flow of water is impeded, requiring them to clear the obstruction. The person on whom such notice is served may within 21 days of service either complain to a court of summary jurisdiction or require a reference to arbitration. Either party may appeal against the decision of a court of summary jurisdiction to a Court of Quarter Sessions whose decision in the matter is final. Then, assuming that the decision is that the person should proceed as required by the notice, and he does not do so within two months, the Drainage Board or Council are empowered to enter on the land and execute the work, recovering the cost summarily as a civil debt.

4. The Standing Committee is informed that there are County Councils and County Borough Councils who do not use their powers in this connexion as actively as they might do. In some counties, immediate action is taken as a matter of routine whenever obstruction is reported, and it usually happens in such cases that the person responsible, on being called upon, at once does the necessary work. Where he does not, it is often found that compliance with the notice follows on the intimation that the Council will itself do the work and charge him with the cost.

5. The Standing Committee would urge all members of the Council who are representatives of County or County Borough Councils to take this matter into personal consideration with a view, in the national interests, of bringing the practice in their own district into line with that followed in other local authorities' areas and described above.

November 19, 1937.

APPENDIX IV

Report from the Standing Committee on the Subject of Rural Housing

1. The Standing Committee has noted the issue of the Second Report of the Rural Housing Sub-Committee of the Central Housing Advisory Committee of the Ministry of Health, on Rural Housing, and desires to record its view that the question of providing adequate cottage accommodation for rural workers is a national one of the first importance. It understands that a Bill to give effect to the Sub-Committee's subsidy recommendations will shortly be introduced by the Minister of Health.

2. The Council will remember that in July, 1936, the Standing Committee brought the general position in regard to the housing of rural workers before them in a report dated May 12, 1936. It discussed the aid given to rural housing by the Housing Acts, 1930 and 1935, and the Housing (Rural Workers) Acts, and made recommendation, *inter alia*, for members to urge their County and Rural District Councils to press forward with the provision of more new and reconditioned cottages under existing Acts. That report was followed by another presented at the December meeting of the same year, in which was definitely recommended the renewal of subsidies to encourage the building of rural houses at rents

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which farm workers could afford to pay. In the last-mentioned report, the Committee stated that whilst it looked forward to the issue of a report by the Rural Housing Sub-Committee (see this Second Report now issued), it regarded the position over the country as serious, calling for early remedial measures. Since that time, improvement has no doubt taken place in many districts, but much urgent work, both by Local Authorities and private owners, still remains to be done.

3. The Sub-Committee in para. 12 of its Second Report throws a clear light on the causes of the increasing shortage of houses for agricultural workers to-day. These are (1) the development of new industries and the growth of neighbouring towns, causing an influx of industrial workers into rural districts; (2) an influx of week-enders; (3) an increase in the number of separate families among the agricultural population; and (4) an increase in the number of retired workers enabled through the Old Age Pensions, etc., to live alone instead of as in former years residing with relatives or in an Institution.

4. The Standing Committee, whilst it does not deplore any of these causes, feels bound to repeat and emphasize them as indicating the wide gap that exists—wider than is commonly thought by an individual having knowledge only of his own district—between the supply of available cottages for young agricultural workers getting married and the demand for them. It seems obvious to the Committee that this matter lies at the root of our agricultural well-being, for without good homes available there will be a rapid falling-off of recruits for farm work, and the industry must come to a standstill.

5. As regards the new Bill which the Minister of Health has so promptly undertaken to introduce, the Standing Committee hopes that it will be made clear in it that the subsidies proposed shall be sufficient to allow houses of a standard three-bedroom type to be let to farm workers at rents not exceeding 3s. a week (inclusive of rates); and that where subsidies for the relief of overcrowding or for slum clearance (under existing Acts) are not sufficient to enable such houses when built for agricultural workers to be let at this rent, some new additional subsidy shall be available, specifically for agricultural workers, to reduce the rents now charged for such houses in rural districts to the above standard figure.

6. The Standing Committee feels sure that the subsidies to private enterprise to be proposed will include subsidies to Housing Associations established under the Housing Acts, and that where these work in conjunction with Rural District Councils, they will be equal with those given to those Councils.

7. As regards the period of operation of the subsidies, the Standing Committee would like to see a longer term than 5 years envisaged in the Bill proposals. If it appears that the subsidies would definitely end in 5 years' time, building might be so pressed forward that costs would rise still higher than they are at present. It might have a steadying effect if it were known that it was the intention to continue the subsidies for 10 years, subject perhaps to general review and reconsideration of them and their results at the end of 5 years.

8. The Standing Committee trusts that Rural District Councils throughout the country will do their utmost to take advantage of the new subsidies to help them to provide good houses for agricultural workers, and wherever members of the Council find themselves in a position, through membership of local councils, to help forward this provision, that they will do their utmost in the matter. The Standing Committee realizes that it is as much by the personal touch and individual enthusiasm of members and officials of Rural District Councils as by the powers of Statutes that a number of new and adequate rural homes can speedily

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be created even with attractive subsidy inducements. The Minister of Health has power under Section 169 of the Housing Act, 1936, to step in where a Rural District Council has failed in its duty under the Housing Acts, and where the County Council has also failed to discharge its duty in substitution for the Rural District Council. Rural District Councils will, we hope, respond generously to the opportunity which the subsidies will give them and which many of them have been anxiously awaiting. If, however, there are cases of default by local authorities the powers provided should be such as will enable the Ministry of Health to take steps to provide the necessary cottages in every case and at the earliest practicable date.

December 2, 1937.

APPENDIX V

Report from Standing Committee on the Food Council's Report on Costs and Profits of Retail Milk Distribution in Great Britain

The Standing Committee has read with very great interest the Report of the Food Council on the Costs and Profits of Retail Milk Distribution in Great Britain, dated September 24, 1937, and issued on November 18, 1937. The main conclusions of the Food Council's Report are that :—

(a) The minimum distributors' margins which are operative are such as to permit of the Co-operative Societies making a high rate of profit on turnover. That rate of profit is, on evidence available, higher than that made by proprietary businesses.

(b) As regards the latter, the rates of profit on turnover differ very widely : some businesses are making a more than liberal rate of profit ; many others are making a moderate rate of profit ; while some are actually making a net loss.

(c) Distributors have called attention to the fact that recent costs have tended to rise : it is on this ground that, under the terms of the Milk Marketing Board's contract for the year 1937-8, distributors have obtained an average increase of $\frac{1}{4}$ d. per gallon in the margin between the wholesale buying prices and the minimum retail prices.

(d) The number of milk distributors in the industry, taking the country as a whole, is excessive ; and this must add to the average distributing cost : redundancy of distributors in any area results in their trying to extend their trade farther afield, with a consequent increase of distributive costs : the higher the cost of distribution in general, the wider will be the margin which the distributing industry will demand.

(e) There is much overlapping, quite apart from that due to any excess in the numbers of distributors : this overlapping is responsible for much uneconomic expenditure.

(f) Excessive competition is in part responsible for distributors giving services which, in a number of cases, are unnecessarily elaborate and which add to operating costs : competition in price is prevented by the fixing of minimum retail prices and this may tend to increase still further the competition in services.

(g) In the main the distributors' margins have been fixed in various areas by reference to the population and without relation to services rendered : in individual cases this means that distributors performing a simple and therefore relatively inexpensive service in any particular area are allowed margins which have been fixed by reference to a more elaborate service and which for the distributors performing a more simple service are excessive.

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(A) The fact that in all districts minimum margins are in operation must in general be detrimental to the consumer as it must in some districts prevent a lowering of the retail price, particularly where the services performed are less elaborate than elsewhere.

The above statement is taken almost verbatim from the Food Council's Report (pp. 33-4). Following it, the Report envisages future possibilities including the freeing of retail prices from control, or alternatively the reduction of minimum distributive margins, or again what the Council conceives as being more important, measures designed to effect some rationalization of the industry.

The Report, farther on, indicates that the following economies could reasonably be looked for as a consequence of rationalization of the industry :—

- (1) Savings by reason of the concentration of processing and distributing depots.
- (2) Savings by reason of the concentration of rounds.
- (3) Savings resulting from a reduction in the number of shops in various areas.
- (4) Decreased costs incidental to book debts and their collection.
- (5) Reduction in expenses of advertising.
- (6) Economies resulting from possible simplification of services.

The views of the Standing Committee on the subject are simply stated. The Committee is surprised at the continuance of the present wasteful and costly system of distribution in spite of the repeated notice of it in reports such as that of the Food Council. It believes that a reduction in distributive costs offers the best prospect of securing a substantial decrease in retail prices to the great benefit of producers and consumers, but it recognizes, as did the Committee of Investigation in 1936, that no appreciable reduction in these costs can be expected under present conditions. It welcomes, therefore, the reference to distributive reform in the White Paper outlining the Government's milk policy issued last July, which concludes with the words " Accordingly, the Government propose, in the legislation that will be necessary to carry out the present proposals, to include provisions to facilitate the improved organization of the distributive service." The Standing Committee hopes that a determined attack will be made, if possible with the full co-operation of distributors, on this most difficult problem.

December 2, 1937.

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The Agricultural Index Number

The general index number of prices of agricultural produce for November is 133 (base, November, 1911-13=100), or 2 points higher than a month ago, and 8 points above that for November, 1936. If allowance be made for payments under the Wheat Act, 1932, and the Livestock Industry Act, 1937, the revised index for the month becomes 137. Compared with October, average prices of barley, fat cattle, sheep and pigs, eggs, butter and milk showed an advance, while those of wheat, oats, hay and wool were reduced.

Monthly index numbers of prices of Agricultural Produce. (Corresponding months of 1911-13 = 100.)

Month	1932	1933	1934	1935	1936	1937
January	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	140
May	115	102	112	111	115	133
June	111	100	110	111	116	131
July	106	101	114	114	117	131
August	105	105	119	113	119	133
September	104	107	119	120	127	137
October	100	107	114	113	125	131
November	101	109	114	113	125	133
December	103	110	113	114	126	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and for the Cattle subsidy (b).

Month	1932	1933	1934	1935	1936	1937
January . . .	—	111	119	124	125	133
February	—	110	117	122	123	133
March	—	106	112	118	122	134
April	—	109	116	126	128	143
May	—	105	116	117	120	136
June	—	104	114	117	121	134
July	—	104	117	120	121	134
August	108	108	122	120	124	136
September	108	111	125	128	133	142
October	104	112	121	119	129	134
November	105	113	120	119	129	137
December	107	114	120	120	130	—

(a) Commenced August, 1932.

(b) Commenced September, 1934.

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In the following table the monthly index numbers of prices of individual commodities are shown for the months of August to November, 1937, November, 1936, and November, 1935; base, the corresponding months of 1911-13=100.

Commodity	1937				1936	1935
	Nov.	Oct.	Sept.	Aug.	Nov.	Nov.
Wheat	120	124	114	118	114	78
Barley	152	148	147	147	115	101
Oats	120	124	125	125	98	87
Fat cattle	113	111	115	119	93	92
„ sheep	137	134	138	141	130	120
Bacon pigs	129	124	124	120	118	93
Pork „	137	131	125	119	126	103
Eggs	126	136	141	138	111	109
Poultry	132	133	130	132	116	118
Milk	181	171	202	175	171	171
Butter	116	111	109	110	97	97
Cheese	121	122	124	126	107	87
Potatoes	156	153	147	127	209	160
Hay	79	86	95	97	102	84
Wool	133	140	146	147	107	91
Dairy cows	119	120	117	114	109	103
Store cattle	107	111	113	119	95	90
„ sheep	116	129	138	142	117	112
„ pigs	167	164	153	141	155	129

Revised index numbers due to payments under the Wheat Act and to the cattle subsidy.

Wheat	132	134	132	124	132*	121
Fat cattle	128	126	130	134	108	106
General Index	137	134	142	136	129	119

* Superseding figure previously published.

Grain. Wheat at an average of 9s. per cwt. was 2d. lower on the month, the index moving downwards by 4 points. (If the deficiency payment under the Wheat Act, 1932, is taken into account the index is 132.) The price of barley at 12s. 11d. per cwt. showed an advance of 4d. and the index rises by 4 points, but that of oats at 8s. 5d. per cwt. declined by 2d. and the index falls by 4 points. In November, 1936, wheat averaged 8s. 7d., barley 9s. 9d. and oats 6s. 10d. per cwt.

Live Stock. During the period under review quotations for fat cattle advanced, the average for second quality, at 37s. 10d. per live cwt., being 6d. higher, and the index rises by 2 points

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to 113. The addition of the subsidy under the Livestock Industry Act, 1937, brings the index up to 128. Fat sheep at 10½d. per lb. for second quality, averaged ½d. more than in the previous month and the index appreciates by 3 points. Baconers at 12s. 11d. per score (20 lb.) and porkers at 14s. 11d. showed increases of 3d. and 9d. per score respectively, the relative indices moving upwards by 5 and 6 points.

Dairy cows were slightly dearer on the month but, owing to a more pronounced rise being recorded in the base period, the current index is 1 point lower. Prices of store cattle and store sheep declined, the relative indices being reduced by 4 and 13 points. Store pigs also were cheaper but the index rises by 3 points.

Dairy and Poultry Produce. During the month, the regional contract price of liquid milk advanced by 1d. per gallon and the index rises by 10 points to 181. Butter at 1s. 4½d. per lb. averaged 1½d. per lb. more than in October, the index moving upwards by 5 points. Quotations for eggs were again higher at 22s. 3d. per 120, but, as a larger increase occurred in the base price, the index recedes by 10 points. The average price of cheese was unchanged at £4 11s. per cwt. but, owing to a slight increase during the corresponding months of 1911-13, a reduction of 1 point is shown in the index. Recent quotations for poultry were about repeated, although the combined index is 1 point lower.

Other Commodities. Prices of potatoes rose slightly during November to £5 10s. 6d. per ton and the index is higher by 3 points. Both clover and meadow hay made less money and the combined index is 7 points lower. Wool at 1s. 5½d. per lb. was 1d. cheaper than in October and the index declines by 7 points.

R.A.S.E. Tractor Test

The Royal Agricultural Society of England sponsors a Tractor Testing Scheme that aims at providing a permanent means by which tractors can be tested on practical lines, the results being published for the guidance of farmers.

Entries of standard machines designed for agricultural use in the United Kingdom are accepted in April of each year, and the necessary tests are made as far as possible during the following autumn.

The following reports have just been issued and copies may

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be obtained, price 2d. each, post free, from the Institute for Research in Agricultural Engineering, Parks Road, Oxford:—

Bristol Tracklaying Tractor.

Case Roadless Model L Tracklaying Tractor.

"Caterpillar" Diesel RD. 4 Tracklaying Tractor.

Fordson Land Utility Pneumatic-tyred Wheel-Tractor.

Fordson Agricultural Wheel Tractor.

Fordson Roadless Tracklaying Tractor.

International Tractor T.D. 35 Tracklaying Tractor.

John Deere Model B.R. Wheel Tractor.

Massey-Harris Pacemaker Wheel Tractor.

Massey-Harris 24/40 Wheel Tractor.

The conditions of the entry of machines have been approved by a committee including representatives of the Society of Motor Manufacturers and Traders, The Agricultural Engineers' Association, The Tractor Users' Association, and the Agricultural Machinery Testing Committee of the Ministry.

Advisory Leaflets

Since the date of the list published in the October, 1937, issue of this JOURNAL (p.698), the undermentioned Advisory Leaflets have been issued by the Ministry:—

No. 41.—Feeding Stuffs for Use with Cereals in Pig-Feeding. (Revised.)

No. 58.—Grey Squirrels (Revised.)

No. 239.—Lime and Its Uses on the Land. (Revised.)

No. 283.—Advice to Intending Bee-keepers.

No. 288.—Basic Slag.

No. 289.—Composts.

Copies of any of the above-mentioned leaflets may be purchased from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or at the Sale Offices of that Department at Edinburgh, Manchester, Cardiff, and Belfast, price 1d. each net (1½d. post free), or 9d. net per doz. (10d. post free).

Single copies of not more than 20 leaflets may, however, be obtained, free of charge, on application to the Ministry. Further copies beyond this limit must be purchased from H.M. Stationery Office, as above.

A list of the Ministry's publications, including leaflets, on agriculture and horticulture may be obtained free and post free on application to the Ministry.

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Agricultural Returns of England and Wales, 1937 Produce of Hops

PRELIMINARY STATEMENT SHOWING THE ESTIMATED TOTAL PRODUCTION OF HOPS IN THE YEARS 1937 AND 1936, WITH THE ACREAGE AND ESTIMATED AVERAGE YIELD PER STATUTE ACRE IN EACH COUNTY OF ENGLAND IN WHICH HOPS WERE GROWN; AND THE AVERAGE YIELD PER ACRE OF THE TEN YEARS 1927-1936

Counties, etc.		Estimated Total Produce		Acreage Returned in June		Estimated Average Yield per Acre		
		1937	1936	1937	1936	1937	1936	Average of the Ten years, 1927-1936
Kent	East ..	cwt. 29,800	cwt. 34,000	acres 1,864	acres 1,990	cwt. 16.0	cwt. 17.1	cwt. 15.0
	Mid ..	43,600	46,600	3,092	3,032	14.1	15.3	13.4
	Weald ..	56,300	70,200	4,961	5,084	11.3	13.8	12.4
	Total, Kent	129,700	150,800	9,917	10,106	13.1	14.9	13.2
	Hants	7,500	7,100	558	556	13.3	12.7	11.5
Surrey		1,300	1,700	112	115	11.6	14.4	11.6
Sussex		18,900	24,200	1,583	1,586	11.9	15.2	13.0
Hereford		55,000	45,000	4,039	3,994	13.6	11.3	10.7
Worcester		22,000	22,300	1,818	1,894	12.0	11.8	10.4
Other Counties* ..		600	900	66	66	9.5	13.0	11.7
TOTAL		235,000	252,000	18,093	18,317	13.0	13.7	12.4

* Salop, Gloucester, and Berkshire.

NOTE.—The total acreage under hops returned in 1937 by occupiers of agricultural holdings exceeding one acre in extent was slightly less than that of the previous year. In Kent, which again returned more than half the total hop acreage, there was a decrease of 189 acres. Hereford alone of the chief hop-producing counties showed an increase, viz. : 45 acres.

The total production is estimated at 235,000 cwt. or 17,000 cwt. less than in 1936 and 9,000 cwt. less than the average for the ten years 1927-1936.

Hops grown by brewers for their own use, or sold by producers under registered contracts, do not come under the marketing provisions of the Hops Marketing Scheme. For this reason the quantity of hops consigned for sale to the Hops Marketing Board is less than the estimated total production of 235,000 cwt.

The yield per acre over the whole of the hop-growing areas is estimated to be 13.0 cwt. compared with 13.7 cwt. in 1936 and an average of 12.4 cwt. for the ten years 1927-1936. In Kent, which returned 55 per cent. of the total production, the yield per acre was estimated to be 13.1 cwt. as compared with 14.9 cwt. in 1936. Both in Sussex and Surrey, although the condition and quality of the crop was good, the yields were lighter than were anticipated and dropped in each county by approximately 3 cwt.

The weather conditions throughout the whole of the season were generally

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favourable and the quality of the crop is very good. Very little disease was reported. The area left unpicked was estimated to be 31 acres as compared with 1,122 acres in the previous year.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Hertfordshire: Mr. W. Q. Connold, B.Sc. (Agric.) has been appointed Lecturer in Agriculture *vice* Mr. R. G. Ferguson, M.Agr., and will take up his duties on January 1, 1938.

WALES

Glamorgan: Mr. J. R. Evans, B.Sc. (Agr.), has been appointed as Technical Assistant.

Farm Workers' Minimum Rates of Wages.—A meeting of the Agricultural Wages Board was held at Kings Buildings, Smith Square, London, S.W.1, on November 30, 1937.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders:—

Buckinghamshire. An Order cancelling the previous minimum and overtime rates of wages and fixing fresh rates in substitution therefor, came into force on December 5, 1937, and continues in operation until December 17, 1938. The minimum rates in the case of male workers of 21 years of age and over are 34s. 6d. (instead of 33s.) per week of 50 hours in summer, except in the weeks in which Easter Monday and Whit Monday fall, when the hours are 41; 48 hours in winter, except in the weeks in which Christmas Day and December 27, 1937, fall, when the hours are 39½, with overtime throughout the period at 10½d. per hour (instead of 10d.), on weekdays, and 1s. 0½d. per hour (instead of 1s.) on Sundays. Easter Monday, Whit Monday, Christmas Day and December 27, 1937. The minimum rates in the case of female workers of 18 years of age and over are unchanged at 7d. per hour, with overtime at 8½d. per hour on weekdays and 10d. per hour on Sundays, Easter Monday, Whit Monday, Christmas Day and December 27, 1937.

Leicestershire and Rutland. An Order varying the previous minimum and overtime rates of wages, the rates as varied came into force on December 5, 1937, and continue in operation until October 29, 1938. The minimum rates in the case of male workers of 21 years of age and over are, in Leicestershire 35s. (instead of 34s.) per week of 54 hours in summer, except in the weeks in which Easter Monday and Whit Monday fall, when the hours are 48; 52 hours in winter (instead of 54), except in the weeks in which Christmas Day and Boxing Day fall, when the hours are 46½ (instead of 48), and in Rutland 33s. 6d. (instead of 32s. 6d.) per week of 54 hours in summer, except in the weeks in which Easter Monday and Whit Monday fall, when the hours are 48; 48 hours in winter (instead of 50), except in the weeks in which Christmas Day and Boxing Day fall, when the hours are 43 (instead of 44). The overtime rates in both counties are unchanged at 9d. per hour on weekdays and 11d. per hour on Sundays. The minimum rates of wages for female workers of 18 years of age and over are unchanged at 5d. per hour, with overtime at 8d. per hour for Sunday work.

Survey. An Order fixing minimum and overtime rates of wages for male and female workers came into force on December 19, 1937 (i.e. the day following that on which the previous rates expired and continues in

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operation until December 24, 1938. The minimum rate in the case of horsemen, stockmen and shepherds of 21 years of age and over is 41s. 6d. (instead of 40s.) per week of 60 hours, except in the weeks in which Christmas Day, December 27, 1937, Good Friday and August Bank Holiday fall, when the hours are 51. In the case of other male workers (except casual workers) of 21 years of age and over the minimum rate is 34s. 6d. (instead of 33s. 4d.) per week of 50 hours, except in the weeks in which the above-mentioned days fall, when the hours are 41. In both cases provision is made for the payment of the minimum rate of wages in respect of the reduced number of hours in Easter week instead of the week in which Good Friday falls if a holiday is given on Easter Monday in lieu of one on Good Friday. In the case of casual male workers of 21 years of age and over the minimum rate is 8½d. per hour (instead of 7½d.). The overtime rates for all classes of adult male workers are 9½d. per hour on weekdays (instead of 9d.), and 11½d. per hour on Sundays (instead of 11d.). In the case of female workers of 18 years of age and over the minimum rate is 6½d. per hour (instead of 5½d.), with overtime at 8d. per hour on weekdays (instead of 7d.), and 9d. per hour on Sundays (instead of 8d.).

Yorkshire (West Riding). An Order varying the previous minimum and overtime rates of wages, the rates as varied came into force on December 5, 1937, and continue in operation until November 23, 1938. The minimum rate for male workers of 21 years of age and over employed as waggoners or other horsemen, beastmen or shepherds is 41s. (instead of 40s. 6d.), per week of the hours specified below in the case of all other workers, with in addition not more than 12 hours per week on weekdays and 3 hours on Sundays and when holidays on full pay are given, 3 hours on those holidays, for work in connexion with the care of and attention to stock. In the case of all other male workers of 21 years of age and over the minimum rate is 36s. (instead of 35s. 6d.), per week of 52½ hours in summer except in the weeks in which Easter Monday, Whit Monday, and August Bank Holiday fall when the hours are 43, and 48 hours in winter except in the week in which Boxing Day falls when the hours are 39½. Provision is made for an adjustment of the hours in respect of which the minimum weekly rates are payable to meet cases where 1, 2, 3, or 4 days' holiday on full pay are given in particular weeks in lieu of Easter Monday, Whit Monday, August Bank Holiday and Boxing Day. The minimum rate for female workers of 18 years of age and over is unchanged at 6½d. per hour for a week of 44 hours.

The overtime rates are, for waggoners or other horsemen, beastmen or shepherds, 9½d. (instead of 9d.), per hour on weekdays and 11d. per hour on Sundays. For all other male workers the rates remain unchanged at 10½d. per hour on weekdays and 1s. 0½d. per hour on Sundays and for female workers of 18 years of age and over unchanged at 8d. per hour on weekdays and 9½d. per hour on Sundays.

Anglesey and Caernarvon. 1. An Order varying the previous minimum and overtime rates for male workers (not being workers employed wholly or mainly in forestry), and minimum rates for female workers, the rates as varied came into force on December 12, 1937, and continue in operation until further notice. The minimum rate in the case of male workers of 21 years of age and over wholly or mainly employed as horsemen, cowmen, shepherds, or hwsmyrn (bailiffs), is 36s. (instead of 35s.), per week of 58 hours. In the case of other male workers 21 years of age and over the minimum rate is 32s. per week of 48 hours in winter and 50 hours in summer (instead of 31s. per week of 50 hours all the year round). The overtime rate for all classes of male workers remains unchanged at 9d. per hour. The minimum rate for female

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workers 18 years of age and over is 6½d. per hour (instead of 6d. per hour).

2. An Order varying the previous minimum and overtime rates of wages for male workers employed wholly or mainly in forestry, the rates as varied came into force on December 12, 1937, and continue in operation until further notice. The minimum rate in the case of male workers 21 years of age and over is 37s. (instead of 36s.), per week of 50 hours with overtime unchanged at 9d. per hour.

Denbigh and Flint. An Order fixing minimum and overtime rates of wages for male workers (not being workers employed wholly or mainly in forestry), and female workers to operate from February 16, 1938 (i.e., the day following that on which the existing rates are due to expire), until February 15, 1939, unless otherwise ordered. The minimum rate in the case of male workers of 21 years of age and over employed wholly or mainly as team-men, cattlemen, cowmen, shepherds, or bailiffs is 37s. 6d. (instead of 36s. 6d.) per week of 60 hours, and in the case of other male workers (except casual workers), of 21 years of age and over 32s. (instead of 31s.) per week of 48 hours in winter and 50 hours in summer. The overtime rate for male workers of 21 years of age and over (other than casual workers), is unchanged at 9d. per hour. The minimum rate for casual male workers of 21 years of age and over is unchanged at 8d. per hour for all time worked, "casual employment" being "employment under a contract of service for a period of less than one week." In the case of female workers of 18 years of age and over the minimum rates are unchanged at 5d. per hour for a week of 48 hours, with overtime at 6½d. per hour.

2. An Order fixing minimum and overtime rates of wages for male workers employed wholly or mainly in forestry to operate from February 16, 1938 (i.e., the day following that on which the existing rates are due to expire), until February 15, 1939. In the case of male workers of 21 years of age and over the minimum rate is 37s. (instead of 36s.), per week of 50 hours with overtime unchanged at 9d. per hour.

A further meeting of the Agricultural Wages Board was held at Kings Buildings, Smith Square, London, S.W.1, on December 13, 1937.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders :—

Berkshire. An Order fixing minimum and overtime rates of wages came into force on January 2, 1938 (i.e., the day following that on which the existing rates expired, and continues in operation until December 31, 1938. The minimum rates in the case of male workers of 21 years of age and over are 33s. 6d. (instead of 32s.) per week of 41 hours in the weeks in which Good Friday, Whit Monday and Boxing Day fall and 50 hours in any other week, with overtime throughout the period unchanged at 9½d. per hour. The minimum rate in the case of female workers of 19 years of age and over is unchanged at 5d. per hour for all time worked.

Cambridge and Isle of Ely. An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution came into operation on January 1, 1938, and continues in operation until December 31, 1938.

The minimum rates in the case of male workers of 21 years of age and over (other than horsemen, cowmen or shepherds) are 35s. (instead of 32s. 6d.) per week of 39½ hours in the weeks in which December 24 and Boxing Day, 1938, fall, 48 hours in any other week in winter ; 42 hours in the weeks in which Good Friday, Whit Monday and August

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Bank Holiday fall and 50 hours in any other week in summer. Provision is made for an adjustment of the hours in respect of which the minimum weekly wage is fixed in the week in which August Bank Holiday falls, to meet cases where an alternative holiday is given on July 25, 1938. The overtime rates are 10d. per hour on weekdays (instead of 9½d. per hour), 1s. per hour on Sundays, December 24, 1938, Boxing Day, Good Friday, Whit Monday and August Bank Holiday (instead of 11d.). For male workers of 21 years of age and over employed wholly or mainly as horsemen, cowmen or shepherds (other than workers employed solely as stockmen or yardmen), the minimum rates are 41s. (instead of 39s. 6d.) per week of the hours specified above and all employment in connexion with feeding and immediate care of animals. For female workers of 18 years of age and over the minimum rates are 7d. per hour with overtime at 8d. per hour (instead of 6d. and 7d. respectively).

Cornwall and Isles of Scilly. An Order fixing minimum and overtime rates of wages for male workers and minimum rates for female workers came into force on January 2, 1938 (i.e., the day following that on which the existing rates expired), and continues in operation until December 31, 1938. The minimum rates in the case of male workers of 21 years of age and over are 34s. (instead of 33s.) per week of 41 hours in the weeks in which Good Friday, Whit Monday, August Bank Holiday and Boxing Day fall and 50 hours (instead of 51 hours) in any other week, with overtime unchanged at 9d. per hour on weekdays and 10d. per hour on Sundays. The minimum rate in the case of female workers of 20 years of age and over is unchanged at 5d. per hour for all time worked.

Derbyshire. An Order fixing minimum and overtime rates of wages came into force on December 26, 1937 (i.e., the day following that on which the existing rates expired), and continues in operation until December 25, 1938. The minimum rate in the case of male workers of 21 years of age and over is 38s. (instead of 8½d. per hour with a provision for payment at not less than 37s. 1½d.) per week of 45 hours in the weeks in which Good Friday, Easter Monday, Christmas Day and Boxing Day falls and 54 hours in any other week. The overtime rates for adult male workers are 8½d. per hour on weekdays (instead of the present system of payment at 8½d. per hour), with the rates for employment on Sundays (including Christmas Day), unchanged at 10d. per hour and employment on Good Friday, Easter Monday and Boxing Day unchanged at 9d. per hour. The rates for female workers of 18 years of age and over are unchanged at 5d. per hour with payment for overtime (i.e. employment on Sundays) at 8d. per hour.

Hampshire and Isle of Wight. An Order continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers from January 2, 1938, until March 6, 1938, and fixing fresh rates in substitution therefor to operate from March 7, 1938, until March 4, 1939. The present minimum rate which is to continue in force until March 6, 1938, is, in the case of male workers of 21 years of age and over, 32s. per week of 48 hours. The minimum rates to operate from March 7, 1938, to March 4, 1939, are 33s. (instead of 32s.) per week of 41½ hours in the weeks in which Good Friday, Easter Monday, Whit Monday, and August Bank Holiday fall and 51 hours in any other week in summer; 32 hours in the week in which Christmas Day and Boxing Day fall, and 48 hours in any other week in winter. Provision is, however, made for an adjustment of the hours in respect of which the minimum weekly rates are payable, to meet cases where one or two days' holiday on full pay are given in particular weeks in summer in lieu of Easter Monday and August Bank Holiday. Overtime rates are unchanged at 9d. per hour throughout the year,

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except in the case of carters, cowmen, shepherds and milkers for work in connexion with the immediate care of animals, in which case the overtime rate is 8d. per hour. The minimum rate for female workers of 18 years of age and over remains unchanged at 5d. per hour for all time worked.

Herefordshire. An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution came into operation on December 19, 1937, and continues in force until December 31, 1938.

The minimum rates in the case of male workers of 21 years of age and over employed wholly or mainly as bailiffs, waggoners, stockmen or shepherds are 38s. 6d. (instead of 37s. as at present) per week (including Sunday) for all time necessarily spent on the immediate care of animals (not exceeding 60 hours), with overtime unchanged at 9d. per hour except for employment on Christmas Day and Good Friday where a worker has completed less than 60 hours in the weeks in which those holidays fall when the rate is 2d. per hour. For other male workers of 21 years of age and over the minimum rates are 34s. (instead of 32s. 6d.) per week of 39½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter; 44½ hours in the week in which Good Friday falls and 54 hours in any other week in summer, with overtime unchanged at 9d. per hour on weekdays and 10d. per hour on Sundays. The minimum rates in the case of female workers of 18 years of age and over are 6d. per hour (instead of 5d. per hour), with overtime at 6d. per hour except for employment on Christmas Day and Good Friday where a whole-time worker has completed less than 46½ hours in the weeks in which those holidays fall when the rate is 1½d. per hour.

Norfolk. An Order fixing minimum and overtime rates of wages came into operation on December 26, 1937 (i.e., the day following that on which the existing rates expired) and continues in force until December 24, 1938. The minimum rates in the case of male workers of 21 years of age and over are 34s. 6d. (instead of 33s. 6d.) per week of 42 hours in the weeks in which Good Friday, Whit Monday and August Bank Holiday fall and 50 hours in any other week in summer; 44 hours in the week in which December 27, 1937, falls and 48 hours in any other week in winter, with, in addition, in the case of workers employed as cowmen of 18 years of age and over a sum of 6s. 6d. per week to cover employment of not more than 10 hours per week in summer and 12 hours per week in winter in connexion with the immediate care of animals (instead of 5s. 6d. per week for all employment on such duties), and in the case of workers employed as teamsmen, shepherds, 5s. 6d. per week, and in the case of sheep-tenders and bullock-tenders, 4s. 6d. per week in lieu of overtime in respect of work in connexion with animals, other than such work on Good Friday, Whit Monday and August Bank Holiday. For work in connexion with animals on those holidays an additional sum of 5s. is payable to special class workers except where a day's holiday on full pay is given in the weeks in which those holidays fall, or in the weeks immediately following. The overtime rates in the case of all male workers of 21 years of age and over are 9½d. per hour on weekdays and 11½d. per hour on Sundays (instead of 9d. per hour on weekdays and 11d. per hour on Sundays). The minimum rates in the case of female workers of 18 years of age and over are 6d. per hour (instead of 5d.), with overtime at 7d. per hour (instead of 6½d.) on weekdays and 8d. per hour (instead of 7½d.) on Sundays.

Warwickshire. An Order varying the existing minimum and overtime rates of wages, the rates as varied came into operation on December 19, 1937, and continues in operation until further notice. The minimum

FARM WORKERS' MINIMUM RATES OF WAGES

rates in the case of male workers of 21 years of age and over are 33s. (instead of 32s.) per week of 39½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter; 41 hours in the week in which Good Friday falls and 50 hours in any other week in summer. The overtime rates are unchanged at 9d. per hour on weekdays and 11d. per hour (instead of 10d.) on Sundays, Good Friday and Christmas Day. Provision is made for an adjustment of the hours in respect of which the minimum weekly wage is payable in the weeks in which Easter Monday and Boxing Day fall to meet cases where holidays are given in those weeks instead of in the weeks in which Good Friday and Christmas Day fall. In the case of female workers of 18 years of age and over, the minimum rates remain unchanged at 5d. per hour with overtime at 6d. per hour on weekdays and 7½d. per hour on Sundays, Good Friday and Christmas Day.

Wiltshire. An Order fixing minimum and overtime rates of wages came into force on January 2, 1938 (i.e., the day following that on which the existing rates expired), and continues in operation until December 31, 1938. The minimum rates in the case of male workers of 21 years of age and over are 33s. 6d. (instead of 32s. 6d.) per week of 41 hours in the weeks in which Good Friday, Easter Monday, Whit Monday, August Bank Holiday, December 24, 1938, and Boxing Day fall; and 50 hours in any other week with overtime unchanged at 9½d. per hour on weekdays and 10d. per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, December 24, 1938, and Boxing Day. The rate proposed for overtime on the hay and corn harvests is 9½d. per hour. The minimum rate for female workers of 18 years of age and over is 6d. per hour (instead of 5d.) for all time worked.

Enforcement of Minimum Rates of Wages.—During the month ending December 12, 1937, legal proceedings were taken against two employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board.

Particulars of the cases follow :—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of wages ordered	No. of workers involved
Carmarthen	Car-marthen	£ s. d. 1 0 0	£ s. d. —	£ s. d. 3 14 9	1
Derby ..	Derby ..	5 0 0	7 14 0	34 16 0	3*
		6 0 0	£7 14 0	£38 10 9	4

* Case of one worker dismissed.

Foot-and-Mouth Disease.—Since the previous issue of the JOURNAL went to press there have been 48 further cases of foot-and-mouth disease.

The disease has appeared in a new area comprising parts of the counties of Dorset, Somerset, Wiltshire, Hampshire, Buckinghamshire and Gloucestershire, and in this area 19 cases have been confirmed. There have also been more cases of the disease in the Kent and East Sussex areas, which have now been combined to form one area of a radius of approximately 15 miles round Stone-cum-Ebony, Kent, and South Malling, Lewes. In this area, 16 cases have been confirmed since November 23, the most recent of these being at Lydd on December 20 and at Stone-cum-Ebony on December 18. It is not possible at this stage to indicate the probable date of any contraction of this area.

FOOT-AND-MOUTH DISEASE

During the period under review, i.e., from November 23 to December 20, the infected area restrictions affecting the following areas have been revoked, viz. :—

Norfolk and East Suffolk; Surrey; Norfolk, Suffolk, Cambridge and Essex; Lincoln (Lindsey); and Essex, Hertford and Middlesex.

In addition, the Huntingdon and West Sussex areas have been considerably reduced in size.

With regard to the "Standstill" Order issued on November 9 and referred to in last month's JOURNAL, the position in the Eastern counties of England had so far improved by December 9 as to warrant the revocation of the order on that date.

On November 26, an outbreak of disease was confirmed at Latimer, Buckinghamshire, but as there was no further outbreak in this area the restrictions were withdrawn on December 18.

The following infected areas are still in existence :—

No. 1. Dorset and Wiltshire Infected Area.—An area comprising 15 miles radius round the infected premises at the following places, namely: Winterbourne Whitchurch, Dorset; Tytherington, Warminster; Laverstock and Ford, Salisbury; Beechingstoke, near Devizes; and East Garston, Berkshire.

No. 2. Kent and East Sussex Infected Area.—An area comprising 15 miles radius round infected places at Lewes, Sussex and Stone-cum-Ebony, Kent, and 5 miles radius round infected places at Lindfield and Haywards Heath.

No. 3. West Sussex.—An area of 5 miles round Petworth. It is hoped to release this area from restrictions on December 27.

No. 4. Essex.—An area of 15 miles radius to the north of infected places at Mucking and Orsett and of 5 miles radius round Stock, Chelmsford. This area will, provided that there are no further outbreaks, be reduced as from midnight on December 20 to an area of 5 miles radius round infected premises at Mucking and Orsett, and will be finally released as from midnight on December 27.

No. 5. Soke of Peterborough, Northampton and Huntingdon.—An area of 5 miles radius round infected place at Wansford.

No. 6. Cheshire.—An area of 5 miles radius round Churton, Cheshire. An order has been issued releasing this area from restrictions on December 23.

No. 7. Northumberland.—An area of 5 miles radius round Morpeth, in this case also an order has been made for releasing the area from infected area restrictions on December 30.

WIRELESS TALKS, JANUARY, 1938

HORTICULTURE

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National :			
Sundays	2.0	Mr. C. H. Middleton	In Your Garden.
Jan. 24	2.5	Mr. B. A. Keen	Plant Growth.
" 31	2.5	"	"
North :			
Jan. 14	6.40	—	Fruit Growing.
" 28	—	—	Fruit Growing.
West :			
Jan. 7	6.45	Mr. D. Harris	" My Post."
" 21	7.30	" and others	Why Flower Shows ?

BOOK NOTICE

AGRICULTURE

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National :			
Jan. 5	6.20	Mr. W. S. Mansfield	Alternate Husbandry.
" 12	6.20	" "	Inspecting a Farm.
" 19	6.20	" "	High v. Low Farming.
" 26	6.20	" "	Successful Farming.
North :			
Jan. 7	6.40	Prof. J. A. Hanley, Mr. John Walker and Mr. Harold Burkitt	Discussion on Land Fertility in County Durham.
" 21	--	Mr. W. B. Mercer	Pigs.
Midland :			
Jan. 6	6.40	Mr. P. F. Astill	Summer Grazing and Management.
" 21	6.40	Mr. W. B. Thompson	For Midland Farmers.
West :			
Jan. 6	6.30	A Young Farmer and an Expert	Poultry Keeping.
" 13	6.0	Plympton Agricultural Discussion Society	Broadcast of a Meeting.
" 20	6.45	A Young Farmer and an Expert	Discussion.
" 27	—	Mr. A. W. Ling, Mr. S. G. Thompson and Mr. J. Nichols	Malt and Barley.
Welsh :			
Jan. 14	--	Prof. Robinson and Mr. Davidson	Discussion on Land Fertility in Wales.
" 15	--	Mr. W. R. Jones	" Unigolion y Tir."
Scottish :			
Jan. 6	6.30	Mr. A. Stewart	Proper Use of Lime and Slag.
" 13	6.10	Mr. R. L. Scarlett	—
" 20	7.30	Mr. A. R. Wannop and Mr. W. K. Leggat	Lowland Ewe Flocks.
Northern Ireland :			
Jan. 3	7.30	—	How and Why of Fixing Egg Prices.
" 10	7.30	Mr. P. Fitzpatrick	Farmer's Work and Worry.
" 17	7.30	Prof. R. G. Baskett	Quality in Feeding Stuff.
" 24	7.30	—	Agricultural Discussion.

BOOK NOTICE

Robert Loder's Farm Accounts, 1610-1620. Edited for the Royal Historical Society by G. E. Fussell. Pp. xxxi + 207. (London : Royal Historical Society. 1936.)

Robert Loder kept accounts of his farm over three hundred years ago, and now, by permission of Vice-Admiral F. P. Loder-Symonds, the manuscript has been transcribed by Mr. G. E. Fussell, of the Ministry of Agriculture and Fisheries, who also contributes an able Introduction.

Born in 1589, Robert Loder entered upon his inheritance at his coming of age. His farm was in the parish of Harwell, on the north side of the Berkshire Downs, and comprised about 150 acres of open field, 100 acres of enclosed down at Awfield, oddments of other enclosures, his orchards,

BOOK NOTICE

the paddock, with grazing rights over the common, and some acres of meadow. It would be reckoned a substantial holding to-day.

Loder was a very enterprising farmer. Whether it paid him better to grow more wheat and less barley; whether he should keep a breeding flock instead of buying in ewes; whether it was more advantageous to him to pay day rates or piece work—these were questions of serious concern to him. His programme of work on the farm was based on the accounts he kept. For instance, he soon found that wheat was his most profitable crop, and, although it was not customary, he accordingly increased its acreage until it approached that under barley. He ran his farm on businesslike lines. He was an early seventeenth century "improver," probably one of many in that period.

Only wheat, barley, peas, beans and vetches were grown. The first two were partly cash crops; the last three useful forage. So far as can be worked out, Loder's rotation appeared to be wheat, fallow, wheat or barley, fallow. This followed the orthodox lines of his day. The yields fluctuated widely; some of the later harvests gave as high returns as to-day's national average. He was justified in proclaiming a return of 13:1 in wheat as a "most marvellous yield." Barley yields were, however, lower than the present average. As regards the hay crop, Loder for the first few years contented himself with the ordinary simple precautions that any farmer would take on meadow lands. He did a little "thisseling"; he hired a mole catcher to destroy the moles and spread their heaps; in the Mead he tried "watering," and from the context it seemed that water-meadows, in an elementary form, had been constructed there.

As horses were the most important animals on the farm they received the best attention. In winter he fed them on rations of hay, chaff, malt, beans and peas. Their summer grazing was supplemented by malt and sometimes green vetches or peas. As for cattle, Loder records that on one occasion seven animals ate nothing but straw after Candlemas Day until the new grass was ready. Later, he kept a dairy herd, and made a profit, though milk yields were low even for his own day. Loder does not disclose very much about his sheep. In winter the scanty grazing was supplemented by straw. In the year 1613 there was much flooding, and he lost 400 sheep through rot. The following year he suffered further losses and warns himself that he should not have bought "after so great a rot year." Pigs he kept for household food only.

From his accounts he computes the whole yield of the farm, and he sets out the amounts sold, what was used in his household, given away, used for feeding his animals and poultry. He charges interest on the money invested in tillage and seed, but does not charge managerial salary. His net profits ranged between £200 and £300 a year. His sales were mainly of wheat and malt. Oddments such as leases for stock on the commons, sales of produce from the orchards, and other items, helped to swell his profits.

Labour costs were of a similar order to others of which there are records. Day rates were 6d. to 8d. in winter, and a penny or so more in summer. For mowing hay or reaping corn he paid 1s. 2d. to 1s. 4d. a day. A shepherd received £2 a year, a carter £3 6s. 8d., a boy £1 4s., and the maids were paid 30s. They all lived in, and Loder calculated the cost of their keep at an average of £10 a year each. Piece-work rates varied from 6d. for threshing a quarter of barley to 1s. 2d. for wheat.

These are only a few of the very interesting facts now brought to light in Mr. Fussell's painstaking transcription of a manuscript which shows us farming methods in Jacobean England. All interested in agricultural history will welcome this volume.

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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NOTES FOR THE MONTH

Agricultural Machinery in England and Wales

The tabulation has now been completed of the replies to the enquiry addressed in September last to all occupiers of agricultural holdings over 1 acre in extent in England and Wales, with regard to the numbers of tractors and other machinery on their holdings at that date. On the basis of the information so obtained, the total numbers of the specified machines on agricultural holdings are estimated to be as follows:—

Wheel tractors for field work	41,500
Wheel tractors for stationary work only	3,420
Tracklaying tractors	1,500
Steam tackle (sets)	1,630
Threshing drums	12,200

No comparable figures are available for earlier years.

Particulars were furnished by 70 per cent. of the occupiers. This is a very satisfactory response.

Numbers of Pigs, Cattle and Sheep in England and Wales in December, 1937

The Ministry recently issued the following statements of the estimated numbers of pigs, cattle and sheep on farms in England and Wales on December 4, 1937, compared with the corresponding figures in June last and in June and December in the two previous years.

The estimates for December, 1937, are based on returns received from two-thirds of the farmers in the country with holdings of over 1 acre.

Pigs. The total number of pigs in December is estimated at 3,914,000, which is 142,000 less than in December, 1936, and 199,000 less than in December, 1935. As in each of the

NOTES FOR THE MONTH

past two years, there has been a material increase in the numbers between June and December. The increase in 1937 amounted to 282,000, which is rather larger than the increase in 1936, but less than that in 1935.

The number of sows for breeding decreased by 32,000 on the year, following a decrease of 27,000 between December, 1935, and December, 1936. The decline in the number of breeding sows between June and December is greater than that recorded in either of the previous two years.

Other pigs of two months and over have increased both in 1935-36 and in 1936-37, but there has been a marked decline over the two years in the number of pigs under two months old.

The figures generally indicate that the increase in the number of pigs recorded on September 4 was due to seasonal causes, and that the decline in pig keeping continues.

ESTIMATED PIG POPULATION OF ENGLAND AND WALES ON DECEMBER 4, 1937, WITH COMPARATIVE FIGURES FOR 1936 AND 1935, AND FOR JUNE 4 IN ALL THREE YEARS.

					1935 <i>Thousands</i>	1936 <i>Thousands</i>	1937 <i>Thousands</i>
SOWS FOR BREEDING—							
June	..	..	..	..	494	483	455
September	..	..	..	..	—	—	472
December	..	..	..	..	507	480	448
BOARS FOR SERVICE—							
June	..	..	..	..	40	34	32
September	..	..	..	..	—	—	33
December	..	..	..	..	41	34	32
OTHER PIGS, 2 months and over—							
June	..	..	..	..	2,074	2,187	2,107
September	..	..	..	..	—	—	2,628
December	..	..	..	..	2,519	2,580	2,604
OTHER PIGS, under 2 months —							
June	..	..	..	..	1,205	1,100	1,038
September	..	..	..	..	—	—	1,223
December	..	..	..	..	1,046	962	830
TOTALS—							
June	..	..	..	..	3,813	3,804	3,632
September	..	..	..	..	—	—	4,356
December	..	..	..	..	4,113	4,056	3,914

Cattle. The total number of cattle on December 4 in England and Wales is estimated at 6,761,000, which is 113,000 greater than in December, 1936, and 251,000 greater than in December, 1935. The December total shows, as in 1936, an increase over the June total. Cows and heifers in milk are estimated at 2,040,000, being a decrease of 4,000 as compared

NOTES FOR THE MONTH

with 1936, and 31,000 fewer than in 1935. Cows and heifers in calf, however, again record an increase, the December estimate of 1,086,000 comparing with 1,058,000 and 1,009,000 in the corresponding months of 1936 and 1935 respectively.

ESTIMATED CATTLE POPULATION OF ENGLAND AND WALES ON DECEMBER 4, 1937, WITH COMPARATIVE FIGURES FOR 1936 AND 1935, AND FOR JUNE 4 IN ALL THREE YEARS.

	1935	1936	1937
	<i>Thousands</i>	<i>Thousands</i>	<i>Thousands</i>
COWS AND HEIFERS IN MILK—			
June	2,232	2,227	2,217
December	2,071	2,044	2,040
COWS IN CALF, BUT NOT IN MILK—			
June	382	405	394
December	606	639	648
HEIFERS IN CALF, WITH FIRST CALF—			
June	437	444	456
December	403	419	438
BULLS BEING USED FOR SERVICE—			
June	86	84	87
December	88	90	93
BULLS (including BULL CALVES)—			
June	40	44	44
December	55	50	49
OTHER CATTLE—			
2 years old and above—			
June	923	913	925
December	860	913	895
1 year old and under 2—			
June	1,314	1,251	1,274
December	1,214	1,250	1,272
Under 1 year, for rearing (excluding Bull Calves being reared for service)—			
June	1,127	1,172	1,165
December	1,213	1,195	1,278
CALVES INTENDED FOR SLAUGHTER AS CALVES—			
June	—	—	57
December	—	48	48
TOTALS—			
June	6,541	6,540	6,619
December	6,510	6,648	6,761

Sheep. The total number of sheep, as estimated from the returns, is 13,740,000, an increase of 828,000 over December, 1936, and of 1,078,000 over December, 1935. The usual fall in numbers from the June figures is recorded, though this is not so large as in the previous two years. Ewes kept for breeding numbered 8,005,000 and show a steady increase, as do lambs intended for breeding.

NOTES FOR THE MONTH

ESTIMATED SHEEP POPULATION OF ENGLAND AND WALES ON DECEMBER 4, 1937, WITH COMPARATIVE FIGURES FOR 1936 AND 1935, AND FOR JUNE 4, IN ALL THREE YEARS

					1935 <i>Thousands</i>	1936 <i>Thousands</i>	1937 <i>Thousands</i>
EWES KEPT FOR BREEDING—							
June ..	..	..	..	..	7,125	7,238	7,321
December ..	..	..	..	..	7,607	7,753	8,005
EWE LAMBS INTENDED FOR BREEDING—							
June ..	..	..	..	..	(a)	(a)	924
December ..	..	..	..	..	977	1,386	1,526
RAMS AND RAM LAMBS TO BE USED FOR SERVICE—							
June ..	..	..	..	..	226	231	241
December ..	..	..	..	..	228	243	253
OTHER SHEEP—							
Under 6 months old—							
June ..	..	..	..	..	7,156 (b)	7,304 (b)	7,140
December ..	..	..	..	..	481	316	315
6 months to 1 year—							
June ..	..	..	..	..	439 (b)	437 (b)	323
December ..	..	..	..	..	2,696	2,673	3,132
1 year old and above—							
June ..	..	..	..	..	1,531	1,438,	1,245
December ..	..	..	..	..	673	541	509
TOTALS—							
June ..	..	..	..	..	16,477	16,648	17,194
December ..	..	..	..	..	12,662	12,912	13,740

(a) Not available: included under (b) for year concerned.

(b) Includes ewe lambs intended for breeding.

Essex Seed Growers' Association

For some years now research has been carried on with the object of improving the strains of various plants that are used for agricultural purposes. In addition, there have been attempts to establish organizations to foster the production, and to encourage the use, of some of the existing strains of particular merit. The importance of strains of all the farm crops has thus gradually begun to attract more and more attention, and it may be that the time is not far distant when it will be the majority, rather than a small minority, of farmers who demand definite strains of seeds, and who will also want some guarantee that the seeds are of the strain they require. As the need for this service increases, it will be necessary for growers of seeds to organize themselves into associations that can undertake to supply authenticated stocks of the various strains that are available.

One such organization, the Essex Seed Growers' Associa-

NOTES FOR THE MONTH

tion, formed in February, 1933, and of which Mr. John Garton is President, might well be taken as a model for others. A scheme for the establishment of such an association was originally submitted to the Essex County Farmers' Union, who appointed a small committee to examine the proposal. This Committee—of which Mr. P. Hutley, Junr., and Mr. Hollis Clayton were Chairman and Vice-Chairman respectively, and who still retain their positions in the Association to-day—recommended that the proposed scheme should be carried out, and accordingly the Association was formed for the purpose of bringing the merits of Essex Late-Flowering Red Clover to the notice of farmers likely to find it of particular value under their conditions of soil and climate. It was held that the aim of the Association was to benefit Essex farmers as a whole, but it was decided to limit the membership to 30 members until the Association became established.

The Association, by inspecting crops of clover grown by its members, and by issuing certificates in respect of those crops that proved to be true, aimed at ensuring that purchasers of certified Essex Late-Flowering Red Clover should be able to purchase the seed with every confidence that they would obtain true and reliable stocks. No restrictions were placed on the sale of certified seed, but the Association arranged that Messrs. Hasler & Co., Ltd., of Dunmow, should act as their agents for dressing the seed, and that certificates should only be issued in respect of seed dressed by these agents and leaving their warehouse in sealed bags.

The East Anglian Institute of Agriculture was in fact responsible for originating this scheme, and it is particularly due to the work of Mr. R. P. Hawkins, the District Agricultural Organizer for North-West Essex, that it was made practicable. Mr. Hawkins was in Devonshire before coming to Essex, and it was there that he commenced the investigations into strains of Red Clover, which ultimately made it possible to start the Association. Inspection of the growing crops, for which a nominal charge is made, has been arranged for by the East Anglian Institute, this service being fitted in with the ordinary work of the District Agricultural Organizer.

At the outset the District Agricultural Organizer also acted as Secretary of the Association, whilst the Agents of the Association, Messrs. Hasler & Co., Ltd., dealt with all trade inquiries. In 1936, Mr. F. T. Smith, Panfield, Braintree, Essex, was appointed Secretary, and Mr. Hawkins was elected

NOTES FOR THE MONTH

to the Executive Committee as Technical Adviser to the Association. The cost of membership of the Association is small, there being an annual subscription of 5s., an entrance fee of 5s., and a levy of 1s. per acre on all crops inspected. These fees are used for the purpose of advertising the seeds of the Association.

At the request of certain of the members Essex Broad Red Clover was brought into the Association's scheme in 1936. Evidence of the value of genuine Essex Broad Red Clover in North-East Scotland has been obtained as the result of trials at the Craibstone Experimental Station of the North of Scotland Agricultural College. The Welsh Plant Breeding Station, Aberystwyth, also made approaches to the Association, and, as a result, members have now started to grow crops of the special strains of seed that have been raised at that Station.

The progress of the Association can best be shown by the following summary of crops inspected:—

<i>Membership</i>			<i>Inspection Crops Acreage</i>		
1933 ..	..	30	Late-Flowering Red Clover ..	9	66
1934 ..	..	30	Late-Flowering Red Clover	16	130
1935 ..	..	50	Late-Flowering Red Clover	14	112
1936 ..	..	50	Late-Flowering Red Clover	17	148
			Broad Red Clover	9	165
			Aberystwyth Seeds ..	7	28
					341
1937 ..	..	55	Late-Flowering Red Clover	16	137
			Broad Red Clover ..	10	160
			Aberystwyth Seeds ..	24	94
					391

It will be seen from these particulars that the Association soon extended its interest beyond Essex Late-Flowering Red Clover, and, in fact, members are now growing 12 different strains of grasses and clovers. The Executive Committee are now considering other schemes of expansion, and one interesting suggestion is that the Association shall extend its facilities to members who have fields registered under the Wild White Clover Certification Scheme operated by the National Farmers' Union and the Ministry of Agriculture and Fisheries, so that the produce of such fields shall be sold in bags sealed by the Association.

The Association holds two meetings annually. The annual general business meeting in January, which is followed by an open lecture by some authority on grass land problems; and a midsummer meeting which is followed by a short tour

NOTES FOR THE MONTH

of inspection of a number of seed crops which are being grown by members. These meetings have been most successful and indicate the great interest that is being taken in the work of the Association. The summer inspection of the seed crops provides a most useful opportunity for discussing the many problems that arise in connexion with seed growing, particularly as to the manurial treatment and time of cutting. These discussions on matters which are at present not very well understood are of considerable educational value, and are by no means a small part of the value of this Seed Growers' Association. The contact that is thus established between the County Education Staff and the members of this Association is likely to prove of great advantage to the members, and to enhance the value of the educational work that is undertaken.

An added interest to the members who grow Essex Late-Flowering Red Clover is the competition for the William Hasler Challenge Cup which is awarded annually to the grower of the best crop. The competition is based on the result of inspections of the growing crop and examination of the seed on delivery to the agents, when marks are awarded for purity, colour and quantity. The winner, in addition to holding the cup for a year, receives a certificate and a small replica of the cup.

The Association is a fine example of co-operation between farmers, merchants and education staffs. It is in a flourishing condition and seems likely to make further headway.

The Accredited Poultry Breeding Stations Scheme

The Accredited Poultry Breeding Stations Scheme in its present form may be said to have developed from the egg and chick distribution scheme, which was in operation up to 1928. The object of the latter was to enable poultry-keepers of the small-holder and cottager type to obtain hatching eggs and day-old chicks at reasonable prices. Following the discontinuance of this scheme, several County Authorities, with the approval of the Ministry of Agriculture, developed schemes of an experimental nature, which became known as approved poultry breeding stations schemes. The necessity for their co-ordination subsequently became manifest, and to facilitate inter-county distribution and assist the expansion of the export trade in stock poultry, it was decided to operate a scheme on uniform lines throughout the country. This led

NOTES FOR THE MONTH

to the inauguration of the present Accredited Poultry Breeding Stations Scheme in 1932-1933.

The scheme is under the direct administrative control of County Authorities, and supervision by the Ministry of Agriculture is maintained through its Small Livestock Inspectorate. Thus a measure of official guarantee is afforded regarding the health and quality of the stock distributed. In most counties, farms applying for accreditation are now placed on probation for one season, in order that the County Poultry Instructor may satisfy himself that the quality of the stock and the system of management are satisfactory, and to enable the breeder to familiarize himself with the requirements laid down in the regulations.

One of the primary requirements of the scheme is that no bird may be bred from until it has passed the blood agglutination test for Bacillary White Diarrhoea. On a Class "A" station, all the birds of six months old or over must be submitted to this test, while on a Class "B" station, the breeding stock only is tested.

The objects of the scheme are to facilitate the supply of hatching eggs, day-old chicks, and adult birds, both as breeding stock for the purpose of egg and table poultry production, and as actual egg producers and birds for table. To assist in the attainment of these objects, the Ministry publishes annually a register of accredited stations and hatcheries, of which copies may be obtained on application. The accreditation of hatcheries is a corollary of the Accredited Poultry Breeding Stations Scheme, and the Ministry has prepared a model scheme for the use of County Authorities desirous of formulating such a scheme in conjunction with their accredited stations.

When the Accredited Stations Scheme in its present form commenced in 1932-1933, it was operated in seventeen counties with 121 stations. Other counties have since adopted the scheme, and the corresponding figures for the 1937-38 season embrace thirty-four counties and 208 stations. In addition, there are now five accredited hatcheries.

Control of Onion and Leek Smut in England and Wales

Smut of onions and leeks is a very serious disease that plays havoc with seedlings and young plants; it occurs on older

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plants also, but less frequently. It is caused by a parasitic fungus, and is contracted from the soil. Fortunately, the disease has not yet become common in this country, the total number of outbreaks known to exist in England and Wales up to the end of 1937 being only 31, distributed as follows:—Northumberland 10, Durham 2, Westmorland 1, Lancashire 2, Worcestershire 12, Northamptonshire 2, Huntingdonshire 1, and Suffolk 1.

It is of the utmost importance, however, that the further development and wider spread of the disease in this country should be prevented by all possible means. Regulations have been in operation for several years to secure this end, and it is the duty and to the interest of all growers to show loyal co-operation in carrying out these regulations, of which a summary is given below, and which may be claimed to have had the effect of confining the disease to comparatively restricted areas, and of preventing any serious loss to the onion-growing industry of this country.

The Importation of Plants Order of 1933 prohibits the landing in England and Wales from any country other than Scotland, Ireland, and the Channel Islands of (amongst other things) any onion "sets" (bulbs) for planting, except in accordance with certain specified regulations.

The Onion Smut Order of 1921 requires the occupier of any land on which Onion or Leek Smut exists, or appears to exist, to notify the fact forthwith to the Ministry or to an Inspector. The sale of plants visibly affected with Onion Smut is prohibited, and those who have affected plants may be required to destroy them by fire or other suitable method. In land declared to be an "Infected Place" for the purposes of the Order, no onion or leek plants may be planted, and no onion or leek seeds may be sown, except under licence. No onion or leek plants grown in an "Infected Place" may be removed therefrom except under licence, unless they are free from soil, and are intended solely for consumption. It may be added that licences to plant or sow are issued only on special conditions as to soil treatment at sowing time and after careful consideration of all the circumstances in each particular instance; such licenses are valid for a limited period only, and are not necessarily renewable thereafter.

Copies of these Orders and of an illustrated Advisory Leaflet (No. 261) entitled "Onion and Leek Smut" may be obtained on application to the Ministry.

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Progress of the Land Fertility Scheme

The Land Fertility Scheme came into operation on September 6, 1937. By the end of the year 67,300 applications for Exchequer contribution under the Scheme had been received from occupiers of agricultural land in the United Kingdom, in respect of approximately 383,000 tons of lime and 203,000 tons of basic slag, involving, it is estimated, contributions amounting to £231,000 for lime and £120,000 for basic slag.

The Land Fertility Committee have issued a Memorandum (L.F.C.4) explaining the procedure for giving provisional approval, as "approved associations" under paragraph 4 (1) (b) of the Scheme, to associations of farmers, allotment holders, or smallholders, or other similar associations, which purchase lime or basic slag in bulk, for redistribution to their members; copies of this Memorandum can be obtained on application to the Secretary, The Land Fertility Committee, 41, Tothill Street, London, S.W.1.

Work of the Land Division of the Ministry, 1936

The recently published Report on the Work of the Land Division of the Ministry for the year 1936 deals with the provision of small holdings and allotments by local authorities under the Small Holdings and Allotments Acts; the administration and finance of the Ministry's farm settlements; the sanction of schemes submitted by landowners for the purpose of loans under the Improvement of Land Acts; the extinguishment of fines and other manorial incidents attaching to land formerly of copyhold tenure; the control and management of commons; sales and other transactions under the Universities and College Estates Act and the Glebe Lands Act; the appointment of arbitrators in connexion with matters of dispute between landlord and tenant affecting agricultural holdings; and the redemption and apportionment of, and other transactions relating to, tithe rentcharge.

The report also deals with the activities of local authorities and the Ministry under the Rats and Mice (Destruction) Act, 1919, and with the administration of the statutory powers for the destruction of injurious weeds.

Another interesting item in the Report is the reference to the conclusion of the campaign against the musk rat or musquash, the importation into and keeping of which within Great Britain have been prohibited by an Order made under

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the provisions of the Destructive Imported Animals Act, 1932. Musk rats have been at liberty in considerable numbers in two areas, in Salop and parts of adjoining counties, and in West Sussex, Surrey and Hampshire, but the measures taken appear to have resulted now in the elimination of this pest.

The Use of Lime

Readers of the JOURNAL are now familiar with the provisions of the Agriculture Act, 1937, whereby farmers can obtain lime at one-half of the cost delivered to their farms.

Farmers generally are well aware of the supreme importance of lime in soil fertility, and they should take the opportunity to make the most of the present concessions. Although, however, the immediate cost of liming is halved, farmers should not use lime indiscriminately, nor will they generally be able to afford the very heavy dressings of lime or chalk that were formerly customary. Soils differ widely in their requirements. Some are already so well supplied with reserves that it would be against the interest both of the farmer and of the nation to incur expense in still further increasing the surplus. On the other hand, farmers need not be deterred from embarking on liming through the belief that lime must necessarily be applied in heavy dressings and at great expense. On some light sandy soils, which are often in most need of lime, a ton or two per acre will often suffice.

Attention is therefore directed to the recent re-issue of the Ministry's Bulletin (*The Use of Lime in Agriculture*).* This has been specially revised with the "liming subsidy" in mind, and is intended to provide information that will assist farmers in working out their liming policy. In addition to reviewing the various forms of lime available and advising as to their application, the publication describes the chemical tests for soil acidity and lime requirement, and briefly mentions the facilities available, under the Ministry's advisory and education scheme, for supplying advice to farmers as to the requirements of their fields.

* Bulletin No. 35. Price 6d. (post free 7d.), from His Majesty's Stationery Office, Kingsway, London, W.C.2.

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SIR DANIEL HALL, K.C.B., LL.D., F.R.S.

The Oxford Farming Conference held on January 4-7 differed from its predecessors in its wider scope. Previously, the papers and discussions had dealt mainly with the application of mechanization to farming and with implements; on this occasion the topics were systems of farming and the basic principles of crop production under present-day conditions.

The Conference was well attended by about three hundred men and women, drawn from all parts of Great Britain, with a few from Ireland, and it was encouraging to note that the majority were young. In the discussions, young men came forward and succinctly described their experiences, and one got the impression that there is a new race of farmers who are anxious to learn and ready to try new things if a good case can be made out for them. It is refreshing, too, to find the Conference little interested in what may be called agricultural politics; except for an occasional allusion to the losses farmers are sustaining and the need for a rise in prices—allusions which provoked little response, but were rather taken as common form—the Conference steadily kept its attention on the technical aspects of farming and the improvement of output.

Professor Scott Watson opened the first day with a general survey of the secular problem—how is the fertility of the land to be maintained? In the last sixty years or so men have been exploiting vast areas of new land in the Americas, Africa, and Australasia. Very generally this has been done without any regard to the permanent productivity of the soil; the pioneer has always conceived of there being more land and yet more land waiting for him, and he has taken what he could get out of his farm and moved on. The result has been that the major foodstuffs of the world have been sold at prices below their real cost, because the depletion of the soil, and consequently the loss of capital, has been ignored. The consequences are now becoming apparent in the accounts of worn-out farms and of land destruction by erosion that are reaching us from many of the countries that a few years ago were flooding the world with cheap cereals. Professor Watson asked what had been the reaction of this cheapness on our

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land; how far have low prices driven our farmers to cash the fertility they had inherited? He concludes that in the better farming districts the fertility of the land is probably higher to-day than it has ever been. It may not look in such a spick and span condition as it has done, because labour has become so costly, but, thanks to artificial fertilizers and imported feeding stuffs, its productive capacity has been raised. On the other hand, he considers that the hill pastures have been deteriorating for the last hundred years under commercial sheep farming, which has been continuously taking away fertility, notably the phosphates, without any measures of recuperation, either chemical or physical. The deterioration is plainly evident in the character of the herbage; cultivated fields have often gone back to rough grazings, *Nardus* and *Molinia* replace heather, Bracken has been spreading and reducing the carrying capacity of the moors. While paying his tribute to the work Professor Stapledon and his colleagues are doing in showing how the hill pastures can be regenerated by the use of lime and phosphates, but more especially by ploughing up and re-seeding, Professor Watson pointed to the even larger areas of indifferent grass land in England, which would give a much more profitable return for expenditure upon them. Sometimes the need is for drainage; sometimes lime and basic slag, to the provision of which the schemes of the Government are directed, will exert a marvellous re-conditioning effect; but in many instances, especially on land of the extreme types, light or heavy, little real improvement can be affected unless the land is ploughed and re-sown. This led Professor Watson to insist on the necessity of such a plough policy *now* as an insurance against the emergency of war. Grass land may be a reservoir of fertility, but the reservoir cannot be drawn upon when there are no ploughs or tractors or horses in the grass areas, above all if there are no men able to use such tools. In the last war the difficulty of extending cultivation lay in the lack of men and implements; to-day we should be starting from a much lower level both of arable land and of men accustomed to working it. Again, old grass land is much less amenable to cultivation than temporary grass that was under the plough a year or two earlier; the turf of old, sour pasture takes a long time to disintegrate, and wireworms are likely to be more troublesome.

Professor Watson concluded his paper with some discussion of the Government's Land Fertility Scheme. He con-

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sidered that the benefits are spread somewhat unevenly, for the Cotswold farmer, for example, does not require lime, and the Scottish farmer at some distance from a railway would prefer, to basic slag, the more concentrated ground rock phosphate for the purchase of which he can receive no assistance. Even when lime or slag is provided, there is much land that cannot be productive until it is drained; but after all the list of desiderata could be extended indefinitely.

Following upon Professor Watson's introduction, the Conference turned to the consideration of its main subject—the management of temporary grass land, or what is now being called alternate husbandry. At the outset a little difference in nomenclature had to be cleared up. To the Englishmen of the South alternate husbandry represents the system that began when prices broke about 1921, and it became evident that the older rotations, with a quarter, or even more, of the land under roots or other fodder crops, could no longer pay for the labour expended. So grew up the plan of alternating temporary leys, left down for three, four or five years, with a similar period of corn crops, which would cash the fertility that had been accumulated by the Wild White Clover that was an essential constituent of the seeds mixture. Roots would be entirely eliminated, except perhaps for a single field of mangolds grown because of their usefulness to the flock. The North Countryman, though he has undoubtedly lengthening his leys since the 'eighties of last century, and depends so much on the fertility due to the growth of Wild White Clover, does not dispense with roots, because he has a larger period when his stock must be kept under cover and need winter keep. Thus, alternate husbandry in the North may mean the mere extension of the ley from one year in the old four-course system to two, three, or even four, years in an extended rotation. The term may have still another significance as representing no more than the practice of having no permanent grass on the farm. Even though the farm may be entirely given up to grass, it is better on many soils to put the plough through from time to time, even if the land is at once re-seeded. Indeed, Mr. J. R. Bond, from Derbyshire, reminded the Conference that there was nothing new in alternate husbandry, that the practice of renewing the pastures, of successively ploughing every field of the farm, had been common form in the West and North from time immemorial.

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On behalf of the alternate system it was argued that temporary grass is more productive; live stock upon it are always less subject to epizootic disease; and farmers, at any rate those who spoke at this Conference, made light of the trouble and expense of laying down a pasture. Moreover, as one speaker put it, why store up fertility indefinitely in permanent grass land when you can cash that fertility at intervals of a few years by turning it into crops?

Professor J. A. Hanley dealt with the methods of securing fertility by improving grass land—drainage, lime and slag. He had something to say about the difficulty of getting the lime and phosphates properly incorporated in the soil; indeed, he insisted that after the herbage has been reformed by such treatment it is only by ploughing and re-seeding that one can obtain full value for the fertilizer that remains accumulated in the surface layer only. Professor Hanley ranged himself strongly on the side of alternate husbandmen; his experience includes land near the industrial districts of Lancashire and Yorkshire so fouled by smoke that it will grow nothing at all until it is broken up.

While Professor Hanley wanted to give attention first to improvement of the lowland grass, he agreed that the hill pasture required consideration, if only because of deterioration in the sheep stocks upon them—upon which stocks nowadays most of the sheep husbandry of the country depends. Even if it is difficult to ameliorate the hill grazings proper, much can be done by improving and extending the area of enclosed land, the lower fields near the homestead. There should be rectified the mineral deficiencies that have become associated with the rough grazings.

A Tweedside farmer, Mr. D. G. Brown, of Cornhill, then discussed methods that characterize that famous farming country. It was predominantly an arable country, worked on a four-course rotation, and it still is an arable country, though the leys stay down for three years on the better land and up to ten or twelve years on the more distant or steeper fields. A mixture is used in which Perennial Rye-grass and Cocksfoot predominate, with a pound of Wild White Clover per acre, but it also contains 6 or 8 lb. of Late Red Clover and Alsike. Mr. Brown insisted that with proper manuring and management these temporary pastures will turn out mutton and beef without any artificial feeding, and will yield profitable crops of wheat and barley when ploughed up; but he made an

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interesting confession—"I can never watch a plough being struck into these good pastures without suffering pangs of remorse. I think it is hereditary from the days when the making of a good grass field was a generation's work."

This point—the reluctance to break up grass land—arose repeatedly for discussion during the Conference. In his opening address, Professor Watson had alluded to restricted covenants, and on the following day Mr. C. S. Orwin pointed out that most Agreements still contain a clause prohibiting the breaking up of permanent grass except by permission of the landlord and under heavy fine. Opinions differed on the actual operation of these clauses; some speakers declared that permission was freely granted, but on the other hand we were reminded that the landlord needed all the protection he could get against a bad tenant, since the Agriculture Act is being so interpreted that a landlord cannot in practice obtain a declaration that a tenant is farming so badly as to justify a Notice to Quit.

As Mr. Orwin pointed out, permanent grass is held sacred because grass farms let more readily; they require less capital and are less subject to market fluctuations of value; and they represent "safety first" to both tenant and owner. Though the first part of the old maxim, "to break a pasture makes a man, to make a pasture breaks a man," has lost its attraction, the latter part is still held to be true in face of the now widespread experience of the certainty with which good temporary pasture can be laid down.

Mr. Orwin dealt generally with the relative values of permanent grass, which one speaker described as a fetish of English agriculture that commanded no respect across the Border. He gave instances of the greater productivity, profit, freedom from disease, value for employment and for national defence, of land managed on the temporary ley system. One might hesitate to break up the fattening pastures of Leicestershire and the marshes in many coastal areas, but even on these rich lands the vegetation has often become coarse and unpalatable, epizootics cause great losses of stock, and the old tradition that it is impossible to re-establish a good pasture has never been tested under modern conditions. The most productive potato and vegetable-growing lands of Lincolnshire, which have made wealth for their cultivators, were ploughed out of old bullock-feeding pastures, generally at the cost of a pretty stiff penal rent.

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While the papers thus far had all set out the advantages to be derived from alternate husbandry, Mr. W. S. Mansfield addressed himself to a discussion of the difficulties, of which many men were so conscious that it had made relatively little headway in the Eastern Counties. There, as a rule, the arable was arable and the grass grass; from the arable the hedges and ditches had pretty well disappeared, so that if it had to be stocked with cattle a considerable initial expenditure was required for water and fencing. Again, it was still by no means easy to establish a good ley on heavy soils where spring droughts prevail. Mr. Mansfield's personal experience on heavy clay land had led him to use a cheap mixture consisting mainly of Perennial Rye-grass with up to 2 lb. per acre of Wild White Clover, and up to 4 lb. of Late-flowering Red Clover. The seeds were drilled in spring in an autumn-sown wheat crop (the soil is too heavy for spring corn) for which a dressing of 10 cwt. per acre of high-grade basic slag had been given. Mr. Mansfield holds by grazing even in the first year, though never too closely, and if the plant is weak through droughty conditions he nurses it with a little nitrogenous manure. The failure of long leys in the Eastern Counties may often be put down to taking hay crops too early and too often. Mr. Mansfield then dealt with the question of how the grass land was to be turned to profit. He claimed that he had been able to send both cattle and sheep to market off his new grass without any extraneous feeding, which was not possible on such permanent grass as could be maintained in the same soil. Other speakers, however, complained that while they obtained plenty of grass and white clover on their temporary leys, it did not seem to possess the same fattening value that, for example, the Tweedside farmer got out of his grass. Earlier in the proceedings, Professor Hanley had insisted that an improved calcium content in the grass was the chief factor in good feeding, and Mr. A. W. Ling had uttered a warning against setting too much value on white clover. The proof of a pasture was its productivity, not its appearance.

Mr. Mansfield had been dealing with clay land, and was followed by Mr. Fisher Crouch, who farmed on the thin lands of Salisbury Plain, also subject to spring droughts. Mr. Crouch's farm was wholly mechanized, but he regarded the alternation of corn with a three- to five-years ley as essential to successful corn growing, the leys themselves being grazed with dairy cattle, sheep and poultry. Mr. Crouch declared

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himself strongly in favour of seeding with the indigenous strains of grasses introduced by the Aberystwyth Plant Breeding Station, in opposition to Mr. Mansfield, who had stated that for his three- or four-year leys he could never afford such expensive seeds and, moreover, that he had found the commercial strains both earlier and more palatable to stock. Other speakers also expressed diverse opinions about the Aberystwyth strains of grasses; on the whole the experiences agreed that they were not so early, but that good grazing was prolonged to much later in the season. One Wold farmer had it both ways by sowing a mixture of half commercial and half indigenous, and he also sowed as much as 4 lb. per acre of Wild White Clover and grazed poultry for the first of his three years' ley.

Mr. N. V. Hewison of Wye College, whose opinion carried the weight due to the exceptional profits he had been making from the College Farm, while agreeing that the indigenous selections from Aberystwyth give a longer if later period of grazing, admitted that his preference for them was a good deal based on the fact that he was saving and selling seed. Mr. Hewison was one of the few speakers who had definite figures to put forward; comparing temporary with permanent grass on the same type of land, he had obtained a live-weight increase of 403 lb. with lambs on the leys as against 313 lb. on the permanent grass. He made out the cost of his leys, for rent, cultivation, manure and seed, as £2 2s. 6d. per acre per year. Another speaker, dealing with the difficulties of establishing pasture on the extreme types of land, extra heavy or very light, advocated autumn seeding without a cover crop.

During the first half of the Conference, the discussion had thus been occupied wholly with the advantages of alternate husbandry, but on Wednesday afternoon Mr. F. Rayns, of Norfolk, put forward a new point of view. He was farming land, of which there was much in the Eastern Counties, that should on business grounds be kept under continuous arable cultivation. He could not afford a long ley in which to build up fertility, and so the Government's Land Fertility Scheme was of little assistance, because lime and phosphates did not add to the stock of nitrogen, unless leguminous crops were taken frequently, and again did not increase the yield of straw, which, by conversion into farmyard manure "is really the sheet anchor of arable farming." This was a return to the old school of farming, which was summed up in a definition

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of agriculture as the art of converting farmyard manure into crops and stock, or, more tersely, of "turning muck into money."

As Mr. Rayns put it, the problem of the man who is continuously cropping arable land, especially of the lighter kind, is how to maintain the humus content of the soil. He can buy the nitrogen that is needed, though what he buys is nitrogen in its fugitive combinations, which have little effect in building up fertility, but are spent in their year of application. Phosphates too are to be bought, and potash is of more importance than might be gathered from the discussion of long ley husbandry. With liberal supplies of potash, the one-year red clover ley, hayed once and then turned in as a well-grown aftermath, was the best means of adding humus to the soil. These red clover crops, however, have to be spread out pretty widely in the rotation because of clover sickness. Mr. Rayns had obtained poor results from ploughing in green manure crops, apart from the waste of land involved in growing the crop, and ploughing in straw had given similar poor results—often the diminution of crop in the first year and no increases until the second year. Indeed, this is now pretty well understood as a matter of competition for whatever available nitrogen there is in the soil between the growing crop and the bacteria destroying the straw or other crop residues. Mr. Rayns had obtained excellent results from the ploughing in of sugar-beet tops, and for this reason would prefer, in a four-course rotation, to put in the whole of the root break with sugar-beet. About the value of sheep folding he was doubtful, not so much as regards the improvement it effected in the land, but from the difficulty of realizing in sheep the values of the crop consumed. Unfortunately, no one else took up this question of the value of folding sheep upon arable land. The "golden hoof" is traditional, and upon sandy types of land there does seem to be value in it, both from the treading and the manurial residues. On other classes of land, good farmers may be found who deny that any better crops follow the fold; the ammonia evaporates and the treading deteriorates instead of improving the texture of the soil. Of course it is understandable that a late fold, when the sheep are not taken off until March, is a bad preparation for barley, but, putting so extreme a case out of question, it would seem that more study might be given to sheep folding, which at one time was regarded as the basis of fertility of

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the lighter lands. According to one good farmer, the secret of retaining both fertility and good texture consists in following the fold closely with the skim plough, just turning up two or three inches of the surface.

In the end Mr. Rayns expressed the opinion that the purely arable farm could not long get on without farmyard manure, so that its profitableness and the maintenance of fertility eventually turn upon meat production (by which he would seem to mean bullock fattening in winter) becoming a paying proposition again. Neither Mr. Rayns nor the speakers who followed him had anything to say about composting or the making of artificial farmyard manure as a means of adding humus and maintaining fertility, but this question of humus, its provision and its function, perhaps merits a Conference to itself. It presses not only on the all-arable farmers like Mr. Rayns, and on the mechanized farmers who wish to eliminate live stock, but even more urgently on the intensive market gardeners who can no longer obtain the stable manure upon which they once depended. There are many questions about humus that demand the investigation of both scientific and practical men.

The remainder of Wednesday afternoon was occupied with a discussion of the methods of fertilizer distribution, whether the aim should be an even distribution of the fertilizer over the surface or its concentration in lines or pockets nearer the growing plant. The data, however, seemed to be still insufficient for any practical conclusions to be drawn.

The latter part of the Conference was mostly concerned with discussions regarding the provision of winter keep by the preservation of fodder crops grown upon the farm, of which grass is naturally the most important. Haymaking is the traditional method of dealing with grass and a good deal of consideration was given to methods whereby the losses generally experienced in haymaking might be reduced. Mr. W. H. Cashmore recounted some interesting studies in the rate of drying of hay and its re-absorption of moisture at night when humidity is high, and passed on to a consideration of the practice of baling partly-made hay in the field instead of stacking. Several other speakers had experimented with this process, success with which seemed to depend on obtaining just the right degree of openness in the bale to permit of the drying process to continue, and on building up the bales in such a fashion as will allow ventilation without the risk

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of collapse when the bales shrink unevenly. The advocates of the tripod seemed to make out the best case for securing hay in good condition.

It was interesting to note a considerable revival of interest in silage, due to the introduction of the acid or molasses treatment to reduce the losses by fermentation. Accounts were given of the cheaply constructed dwarf silos that prevail in Holland, and of portable wooden silos to be used in the field and so minimize carting, but a speaker from New Zealand insisted that good results can be obtained with good stacks. Of interest was the reported use of silaging to conserve, on the one hand, beet tops, and on the other, green-pea haulm where peas are grown for canning. The haulm is valuable food, but becomes an intolerable nuisance if it cannot be got rid of immediately.

The real difficulty about silage making, as about grass drying, was pointed out by Mr. A. Bridges—its heavy call for labour when labour is wanted elsewhere on the farm. For this reason one speaker would reserve silage for early grass, leaving the main cut to be dealt with by haymaking.

The final day of the Conference began with an important paper, by Dr. Garrett of Rothamsted, on the root fungi of the soil that may prove, and in some districts are proving, a considerable obstacle to methods of farming involving a succession of straw crops. Dr. Garrett dealt particularly with "take-all" or "Whiteheads" in wheat and barley, which he had been investigating in Australia, and the *Cercospora* fungus that causes lodging by attacking the base of the stem. It is difficult in a short space to set out Dr. Garrett's conclusions, for no effective means of control have yet been found. Indeed, some of his recommendations, for example, to defer the sowing of wheat to as late in the autumn as possible, are in conflict with what is otherwise the best practice. These diseases, however, merit the most serious investigation as they threaten some of the recent improved methods of farming.

The final sitting of the Conference returned in some measure to its earlier study of alternate husbandry, for Mr. D. Skilbeck opened a discussion on the subject of weed prevention. The critics of all methods of farming that involve even a short succession of straw crops and no roots, are always asking how the lands can be kept clean. Mr. Skilbeck's chief text was "wild oats," with "black bent" one of the most trouble-

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some of arable weeds because it will only germinate in the wheat, and sheds its seed before its crop is harvested. Mr. Skilbeck spoke of the value of burning the stubble as a means of stimulating germination; this, indeed, is the desideratum, for even a bare fallow does not induce the germination of some of the most difficult weeds.

The interest in the Conference was maintained to the end, and everyone felt it had been a great success. It owed much to the organizing ability of Mr. S. J. Wright; printed copies of the papers to be read were available every morning, times were kept, lodging arrangements and visits experienced no hitches. Professor Watson and his colleagues made charming hosts; the dinner in the noble Hall of Christ Church was much enjoyed if a little chilly, and it is reported that the late discussions in Hertford were worth more even than the public meetings.

FARMING IN SOVIET RUSSIA

SIR E. J. RUSSELL, D.Sc., F.R.S.,

Director of the Rothamsted Experimental Station

The vast territory commonly called Russia, but more properly named the Union of the Socialist Soviet Republics, is not only the largest self-contained political unit in the world but includes also a wider range of natural conditions from Arctic to sub-tropical than can be found anywhere else. Its variety of agricultural products is correspondingly wide, including the cold northern crops, rye, flax and potatoes; the more temperate crops, wheat, sunflower and sugar-beet; and such sub-tropical crops as oranges and tea. Nowhere else can so many different crops be seen in one country.

Only a small part of the land, however, is cultivated. Of the 8.25 million square miles, only about 330 million acres (about 6 per cent.) are in actual cultivation. The remaining 94 per cent. includes forest 44 per cent.; pasture and grass land 13 per cent. (corresponding to our "rough grazing," though 2 per cent. is called grass land); the rest is waste, or at least non-agricultural land. The present population is estimated at between 168 and 170 millions and it is growing at the rate of about 2 millions per annum: averaged over the whole area, the density is about 20 to the square mile, or concentrating them all on the cultivated area, a density of 1 per 2 acres.

With so wide a variation in natural conditions it is impossible to speak of any particular system of Russian agriculture. The systems vary in the different areas according to the conditions.

One general feature, however, runs through most of them, and this is the preponderance of grain cultivation and the low production of animal products as compared with the agriculture of western Europe. Out of the 133,000,000 hectares cultivated in 1935 no fewer than 103 million were in grain of various kinds, this being 75 per cent. of the arable land, as compared with 44 per cent. in England and Wales. On the other hand, fodder crops, which figure so largely here, occupied less than 9 per cent. of the land.

The area of cultivated land varies somewhat from year to year, but has increased since 1913, as also has the population.

FARMING IN SOVIET RUSSIA

The figures are given in Table I. The principal crops are in order of areas sown: wheat, rye, oats, millet, barley, potatoes, sunflower, maize, flax, cotton. The areas sown, in million hectares, are given in Table I.*

TABLE I.—AREAS OF PRINCIPAL CROPS SOWN IN THE U.S.S.R.†

	1913	1928	1930	1931	1932	1933	1934	1935	1936	Plan for 1937
Total area sown ..	105.0	—	127.2	136.3	134.4	129.7	131.5	132.8	133.7	138.9
Grain crops ..	94.4	—	101.8	104.4	99.7	101.5	104.7	103.4	—	103.96
Rye ..	24.9	24.1	—	—	26.2	25.4	23.6	23.1	—	—
Wheat ..	31.1	27.6	—	—	34.6	33.2	35.1	37.0	—	—
Spring corn, including wheat ..	—	—	—	—	—	—	—	—	—	65.4
Potatoes ..	—	5.6	5.7	6.1	6.1	5.6	6.1	—	—	—
Vegetables and fruit ..	3.8	—	8.0	9.1	9.2	8.8	—	9.9	—	—
Fodder crops ..	2.1	—	6.5	8.8	10.6	7.3	7.1	8.6	—	13.7
Technical crops ..	4.5	—	10.5	14.0	14.9	12.0	10.7	10.6	—	11.0
including:—										
Sunflower ..	0.9	3.9	—	—	5.3	3.9	3.5	3.3	—	3.1
Flax and hemp ..	1.0	1.4	1.4	—	4.1	2.4	2.11	2.1	—	2.4
Cotton ..	0.7	0.9	—	—	2.3	2.0	1.9	1.9	—	2.1
Sugar-beet ..	0.6	0.7	—	—	1.5	1.3	1.1	1.2	—	1.2
Tea ..	—	—	—	—	—	—	33.598	—	—	—
Population in millions ..	139.3‡	—	154.3 (1929)	—	—	165.7	—	—	168-170	—

* 1 hectare = 2½ acres. The figures are left in hectares as they are always given in this form in official publications.

† From Sel'skoe Khoziaistvo S.S.S.R., 1935 (Statistical Year Book for 1935, the latest available).

‡ Within the present boundaries of the U.S.S.R.

This preponderance of grain production is not peculiar to Russia: it is characteristic of other non-tropical Continental regions consisting mainly of great rolling plains: it is seen in Canada, Australia, the plains of Hungary and elsewhere.

In speaking of their agriculture the Russians always lay the greatest stress on the development of their technical crops as shown in Table I; this is one of the consequences of their policy of increasing the industrial production of the country. Russia now produces the whole of the sugar, flax and cotton that it consumes. As an example, the areas of sugar-beet and the production in million centners are as follows:—

	Harvest Yield (millions of centners)	Area (million hectares)	Average Yield per Hectare (centners)
1913	109.0	0.6	180
1928	101.4	0.8	125
1932	65.6	1.5	41
1935	162.1	1.1	147
1936	230.0	1.3	176
1937	245.0	1.2	204

Average for 6 years = 145 centners per hectare = 5.8 tons per acre
The highest annual yield (1937) averaged 204 centners, corresponding to 8 tons per acre.

FARMING IN SOVIET RUSSIA

The distinctive features of Russian agriculture is that it is definitely planned by the Central Authority: it is not left to the farmers' judgement of what is likely to be most profitable. The Central Authority decides that certain quantities of the various agricultural products are required and allocates to each of the constituent Republics its share in the production. A counter plan may be put forward but ultimately agreement is reached. Each Government then allocates to the Regional Head of the Agricultural Department through the Regional Commissars (Ministers) the share of each Region in the work: and each Regional Head allocates shares to the District Heads of Departments. These call together the chairmen of the collective farms in the districts, and between them the various quotas are assigned, so that each farm knows what it is expected to produce: each has its "plan." The Chairman must see the plan through, and the district agricultural organization of the Party sees that he does it. Every farm is told, therefore, what crops it must grow and how much it must produce. After the plan is settled there can be no more discussion and the plan must be fulfilled; there is no appeal of any kind. Total acreages are fixed and also average yields per acre, yields of milk per cow, yield of meat, etc.*

In order to understand the organization of the farms it is necessary to know how they arose.

When the Bolsheviks took charge of the Government of Russia they resolved to apply Marxist principles to agriculture with the same completeness as they had applied them to industry. The problems, however, proved much more difficult. The factory workers easily apprehended the underlying idea of State ownership of the factory, and each one knew perfectly well that the factory never could belong to him. The peasant, however, had an old ingrained belief that the land was his. There was an old peasant saying "My back belongs to my master, but my land is mine." There are good grounds for the belief that the peasants joined the Revolution not out of any desire for Communism but to eliminate the landlord

* By the decree of the Central Executive Committee and the Council of People's Commissars of the U.S.S.R. the quantities "Fixed" for the U.S.S.R. for 1937 include: total area of grain sown, 103.96 million hectares; average yield of grain, 10.4 centners per hectare (= 8.3 cwt. per acre); average yield of milk per cow, 1,400 kg. (= 3,100 lb.); live-weight of pigs at slaughter, 80 kg. (= 178 lb.); clip per sheep at beginning of 1937, 2.6 kg. (= 5½ lb.), and so on.

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and so secure possession of the land. The Bolsheviks, on the other hand, took the view that the Revolution would have failed if the peasants were left as owners of the land. So began a trial of strength in which both sides suffered greatly. The townspeople went hungry for some years because the peasants produced only small quantities of food, especially of meat and dairy produce, so that these things became very scarce and dear.

TABLE II—U S S R NUMBERS (MILLIONS) OF LIVE STOCK*

	1916	1929	1930	1931	1932	1933	1934	1935	1936†	Plan for 1937
Horses ..	31 5	34 0	30 2	26 2	19 6	16 6	15 6	15 9	16 6	—
Cattle	58 9	68 1	52 5	47 9	40 7	38 6	42 4	49 3	57 0	—
Cows	—	—	26 7	24 4	21 0	19 7	—	—	—	—
Sheep and goats	115 2	147 2	108 8	77 7	52 1	50 6	51 9	61 1	64 0	73 3
Pigs	20 3	20 9	13 6	14 4	11 6	12 2	17 4	22 5	30 4	—

* From Sel'skoe Khoziaistvo S S S R, 1935 (Statistical Year Book for 1935, the latest available)

† Provisional taken from Monthly Review, February 1937, p 84 and March, 1937, p 131

The peasants, on the other hand, and especially the small farmers, were "liquidated" by the thousand: no one knows how many lost their lives during the struggle. In the end the Bolsheviks won their point that individual ownership of land and means of production must cease, and that henceforward the ownership must be by the community and not by the individual. The peasants, nevertheless, won their point that each must have some land secured to him, also such live stock as he can maintain: and further, that the ownership of the farm, if it is to be by the community, shall be by the particular community that is farming it and not by the State as a whole. In my earlier visits to Russia in 1930 and 1934, the struggle was still going on, and one could not fail to notice a good deal of disaffection among the peasants. This revealed itself in the figures for numbers of live stock, always a very sensitive index of agricultural conditions: there was a catastrophic fall, many of the animals being eaten rather than given up, and many died. On my latest visit (summer of 1937) it was evident that the peasants were becoming more contented. Each householder may have from $\frac{1}{2}$ acre up to 2 acres of land, held if not in ownership at any rate on a tenure that satisfies the peasants' wishes; many of them have, and all are intended to have, a

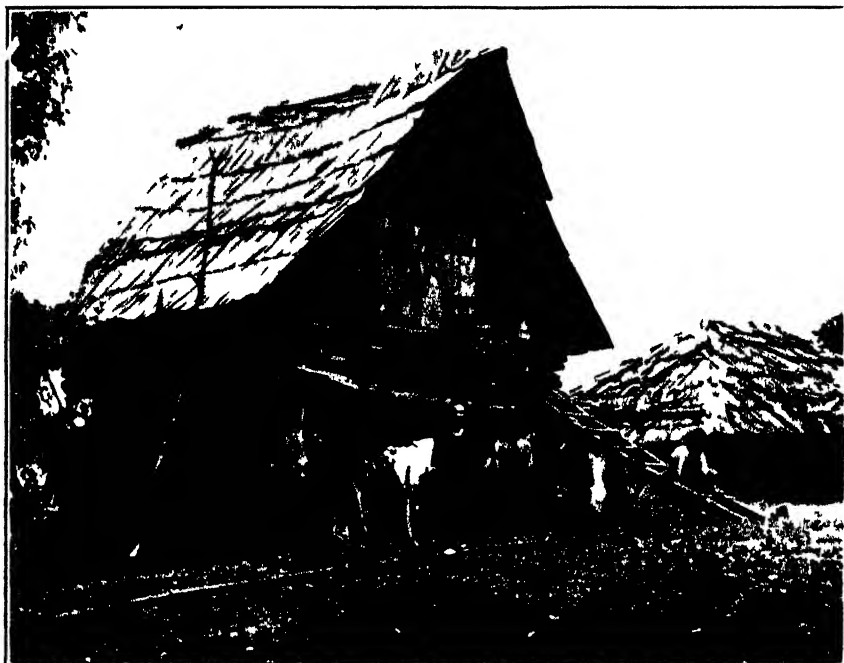


FIG. 1. Collective Farm Voroshiloff. The old home.



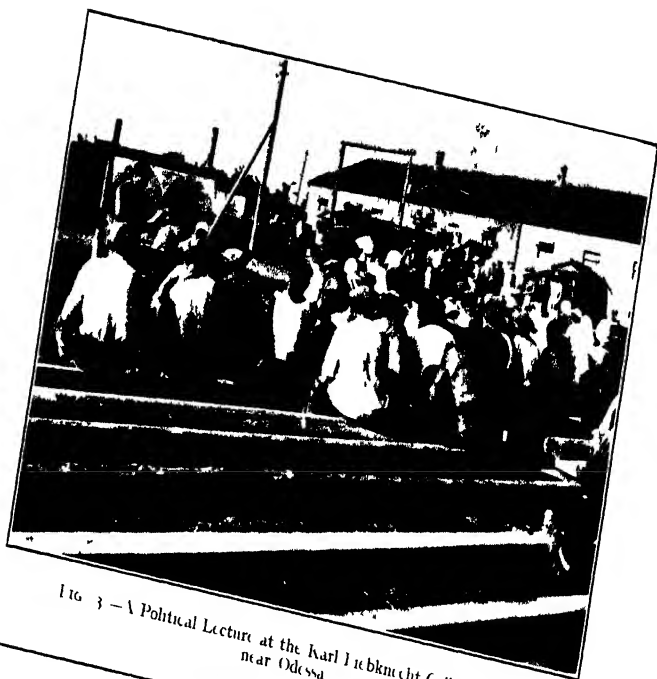


FIG 3 — A Political Lecture at the Karl Liebknecht Collective Farm
near Odessa

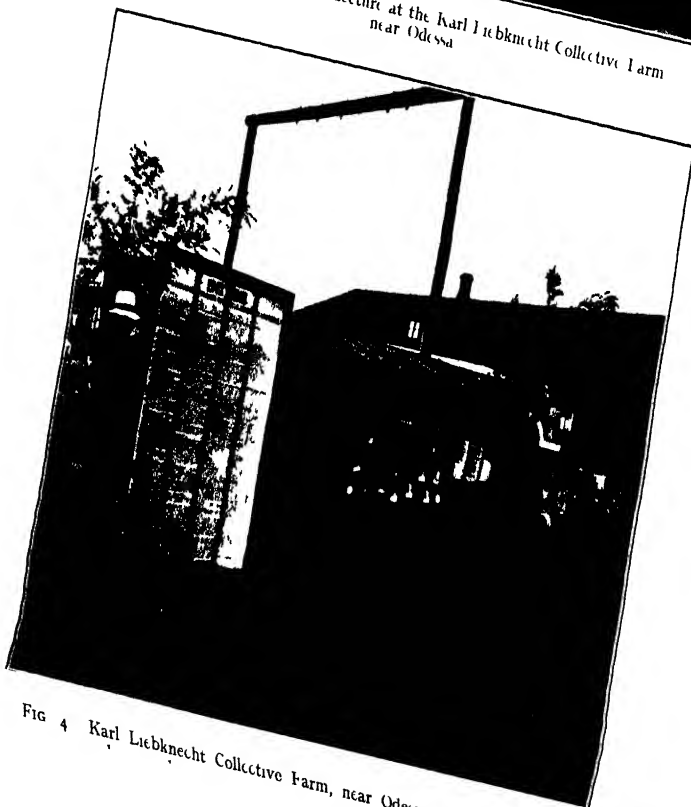


FIG 4 Karl Liebknecht Collective Farm, near Odessa The Regulations,

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cow, a few pigs and some poultry. The great source of pride, produced always with sparkling eyes and much enthusiasm, was the deed of settlement, only recently received, elaborately written in the chief languages of the Union on stiff white paper and bound in an attractive binding, which the peasants show as their title of ownership of the collective farm. This farm, they feel, is now theirs, as well as the houses in which they live and the bit of land that goes with it.

There are two types of farms: State and collective. *The State Farms* belong to the State, as their name implies; they are managed by State officials and the employees receive a definite wage—they are paid on a piece-work basis—"progressive piece work" is the phrase adopted. This method accords well with the underlying principles of Communism and in point of fact was widely adopted in the early days of the Revolution; but it does not accord well with the ideas of the peasants, and so the area under State farms has steadily decreased, and at the present time if a collective farm wishes to expand it can claim possession of a State farm for this purpose.

The Collective Farm works on a completely different basis and represents something, which so far as I know, is entirely new in the history of agricultural organization. The whole of the peasants of the village are brought together into an organization called the Collective Farm. They bring into it their land and all their agricultural implements and their animals: no compensation is paid for anything and no objection is permitted (there is a short way of dealing with all objectors and dissenters in Russia). The organization thus starts free of debt and of all capital obligations whatsoever: the farm may consist of about 2,500 or more acres, of which about 50 to 70 per cent. may be arable, and may have about 300 to 500 workers (i.e., about 16 workers per 100 acres) according to the quality of the land and the cropping. The workers elect a committee of management and a chairman: the Committee meets at regular intervals—usually several times a month—to decide on the arrangement of the work and the day-to-day decisions are taken by the chairman. The Committee organizes the workers into brigades, to each of which is allotted certain duties: one or two are in charge of live stock, one in charge of orchards, several in charge of crops—and so on. Specially good workers receive a special title: they are called "Stakhanovites," named after the now famous workman Stakhanov, who found

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various ways in which he could increase his output. The declared aim of the workers is to do more than the allotted task, and it is always said that the eye of the fellow-worker is the best incentive to hard work.

No wages are paid, but the residue of the produce, after the various outgoings have been met, is divided among the workers according to the work they have done.

The work is assessed directly and not on a basis of hours. The Committee decides that a certain quantity of work, such as a certain area of land ploughed or a certain number of cows tended and milked, can be called a day's labour. Each worker's labour record is kept and at the end of the year the number of "labour days" he has accomplished is added up. For ordinary workers this may amount to anything between 150 and 400 days per annum, but for the Stakhanovites, or very good workers, it may be as much as 800 days per annum. The produce is then shared out according to the number of labour days.

Some of the allocations per labour days are given in Table III.

TABLE III.—SHPITKY, KIEV. LABOUR DAYS

1933			1934 (expected)	1935	1936	1937 (expected)
Grain ..	kilos	1	3	1·8	2	4
Potatoes ..	"	5	6	4	10	12
Hay ..	"	4	8	1	1·5	2
Vegetables ..	"	3	3	1·5	2	2
Apples ..	grams	100	200	—	—	—
Honey ..	"	—	—	100	200	300
Cash ..	"	79 k.	3 r.	70 k.	1 r. 10 k.	2 r. 50 k.

Labour days per annum : 1936, 150-700.

These are for the farm of Shpitky which I visited in 1934, and again in 1937. The figure "expected for 1934" was given me in August of that year before the accounts were finally made up, and are almost certainly an overestimate: as also is the amount "expected for 1937": neither the potatoes nor the honey could furnish so much for the workers. The general position is clear, however: the worker has his share of the produce and can either eat it or sell it direct to consumers in the open market or to a co-operative society.

FARMING IN SOVIET RUSSIA

The outgoings of this farm are as follows:—

For Government. 2 per cent. gross amount of all receipts from sales.

Grain. 32 kg. per ha., for which the Government pays: for wheat, 48 k. per pood (i.e., 1 r. for 75 lb.); for rye, 44 k. per pood.*

Potatoes. 3 dz. per ha. (2.4 cwt. per acre), for which the Government pays 7 r.

Milk. 58 litres (12½ gal.) per cow, for which the Government pays 12 k. per litre.

Pork. 2 tons at 1 r. per lb.

Beef. 22 cwt. at 76 k. per lb.

* 1 pood = 36 lb.; 100 kopecks = 1 rouble. The value of the rouble is difficult to estimate: the visitor buys roubles from the State Bank at about 9d. each, but in the shops, judging by English prices, they are worth about 2d., except when buying black bread for which they are worth more, if one allows the same price for black bread as for English white bread—which of course one should not.

The Government demand for grain, potatoes and milk amounts to about 4 or 5 per cent. of the average yields fixed by law. There is no means of knowing how far these yields are in fact attained: at each farm I visited the Chairman assured me they were actually reached or even exceeded. On several farms in one district I was, in 1934, given the official figure (8 cwt. per acre) as the yield of grain, but inspection on the field showed that the yields, whatever they were, could not all have been the same. After the Government share has been set aside the remainder is divided up for the following purposes:

For M.T.S. (Motor Tractor

Section:)

Grain	3 per cent.
Potatoes	3 dz. per hectare (2.4 cwt. per acre).

For Insurance and Seed:

Grain	12 per cent.
Potatoes	7 "

Old and Sick People:

Grain	2 per cent.
Potatoes	2 "

Day Nursery and Crèche:

Grain	1½ per cent.
Potatoes	1½ "

Live Stock:

Grain (inferior) ..	12 per cent.
Potatoes (small) ..	10 "

The remainder is divided among the workers according to their labour days. As already stated some workers have only about 150 labour days a year, others have as many as 800: it is typical of modern Russia that all work is piece work, and in consequence the earnings are very unequal. The wage

FARMING IN SOVIET RUSSIA

system is therefore payment in kind, and from the consumers' and Government point of view has the advantage that prices do not come into play and the peasant bears the risk of variable yields.

The numbers of workers seem very high to an Englishman: there were 700 of them, and a total population of 2,000. The farm is 4,500 acres, of which 750 are orchard, 200 kitchen garden and 3,000 arable, mostly grain, but with 300 acres of potatoes. The live stock consists of 300 cattle, of which 130 are milking cows: these all graze in summer but are housed for 4 months in winter. There are also 120 horses with 60 young ones. Tractor power is supplied by the M.T.S. (Motor Tractor Station). The standard of farming may be judged by the yields: 6 to 10 cwt. per acre of grain, 4 and 6 tons per acre of potatoes, milk probably about 300-400 gallons a year (this figure was given me in 1934: nearly double the yield was claimed for 1937). On an English farm of this size one might expect to employ at the outside about 190 men* so that the Russian workers are three or four times as numerous as would be required here. On other farms the proportion was about the same,† and even allowing for short time it seems safe to assume that the British agricultural worker is about three or four times as efficient as the Russian. I give the figures for purpose of illustration only: comparison would be unfair because the British agricultural worker is very efficient and the level of production per acre and per animal is much higher than in Russia.

I have described the Shpitky farm at length because it is typical of all the general farms I saw; but the proportion of orchard varies on different farms, as well as the numbers of live stock and the amount paid per labour day.

* About 60-80 men on the arable land, about 10-15 for the live stock, about 40-60 for the orchard and 20-30 for the kitchen garden: but the orchard and kitchen garden did not come up to English standards.

† Other figures—also given only for purpose of illustration—are as follows:—

<i>Total Area of Farm, ha.</i>		<i>Arable Land (including vegetables and fruit), ha.</i>		<i>Total Population</i>		<i>Total Number of Workers</i>
1,832	..	850	..	1,650	..	480
1,180	..	700	..	800	..	460
1,330	* ..	420†	..	1,200	..	640
2,601	..	800§	..	1,946	..	734

† In Georgia: including 165 of tea.

§ Including 214 market garden.

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The village is thoroughly typical. The cottages are built along a street, each in its patch of ground; they are plain and unattractive, one storey only, with two or three rooms each containing beds, one containing also a table and a few chairs: there is usually a small store place. On the walls often hangs a large portrait of Stalin, and in the corner there is usually the ikon or sacred picture, which still remains though it is explained that it has no meaning for the younger people. There are occasionally a few poor personal photographs, but none of the ornaments one sees in an English cottage, and no "parlour." The older women still have some of their embroidery which they show with pride, but the younger ones do not. Water is supplied from wells. There are no shops, no cinemas, no garages, no public-houses or hotels, no picturesque corners and no chapels: and the Church is commonly used as a club or a grain store.

There is, however, a school of which the villagers are proud, and also a crèche where the babies are left while the mothers go out working—for in Russia the women work just like the men, doing everything that a man can do and not infrequently doing it better. Usually, also, there is some meeting-place, for the "Party" attach great importance to political propaganda, and lectures are given setting out the Party's views on home and foreign affairs. There being only one Party, and no opposition and dissent, no discussion of the kind familiar in England can take place, and the lectures are very different from anything to which we are accustomed. There are crowds of children, and indeed the Russian Government is encouraging their production by giving for the seventh child a bounty equal to about 2 years' pay. The children are cheerful and attractive, and their parents have some very likeable qualities. The educated Russians are among the most charming people one can find.

On the State farms money only is paid, and the range of wages in those I visited was from 250 to 400 roubles per month, the Stakhanovites earning 600 roubles. These compare with wages of 250-275 roubles paid to unskilled workers in the towns, 800 roubles that the best workers (Stakhanovites) can obtain, 400-800 to teachers, 500 upwards to doctors.

The only difficulty is that the peasants have so little on which to spend their money, and the great need now is to increase the production of commodities such as the peasants desire in order that their earnings may have real value for them.

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Some parts of the country show marked improvement since my earlier visits, particularly Armenia. In 1930 there were only very few motor-cars in that country; I was assured there were only 10 and one of these was lent to me. The number is now considerable, and there are even more motor lorries. The main roads have been improved, and where new houses are being built in the villages they represent a considerable advance in comfort and healthiness on the old ones. These new houses have two good rooms, with a hall that can serve as a store or a small room, and also a verandah. Armenia is benefiting by the irrigation schemes that are now being put forward. Both here and in the other areas I visited there was more food than when I was there before, and in the towns more colour in the women's dresses; there is a material improvement.

I have already stated that the peasants seem more content with the system of collectivization than in 1930 or 1934, and in consequence the system now has a chance of showing what it can do. Some 98 per cent. of the sown area is now in collective farms.

Leaving aside the wide political and social issues involved in this Russian experiment of complete direction and control of agriculture by the State, there are many purely technical aspects of it which are of great interest. The experiment is, in my opinion, being made under more favourable conditions for success than would exist in most other countries, and its results will be watched with great interest by all students of agriculture.

STARTING A CENTRAL APPLE PACKING STATION

CLIVE BURTON, Dip. Agric. (Wye)

The great changes that have taken place in this country during the last ten years, in the methods of growing high grade apples, have brought to the notice of producers the fact that the growing of an article second to none for quality and flavour will not be satisfactory if that product is not marketed in an attractive form.

The enormous imports of apples, which in the first place had to be well packed to stand the long journey, have made buyers demand the same standard for home-produced fruit. Owing to geographical considerations, such fruit is largely bottle-necked at relatively few exporting ports, and the inspection for standardization and regulation of supplies to markets is greatly simplified.

In this country, with markets practically at the gates of the orchards, stringent grading and packing, and a means for regulating the supply of fruit reaching the markets, have been slow in materializing. Growers, however, are now forced by economic pressure into better presentation and marketing of their wares.

When improved packing is commenced on the farm with anything over 20 acres of bearing fruit, a number of problems arise, the main ones being, (1) that some form of power grader is required, (2) to keep up the standard of packing (and secure efficiency), a considerable amount of intelligent supervision is necessary, and (3) refrigerated storage calling for large capital outlay and skilled attention must be installed. A grower carrying out all, or even part, of the above operations, finds that a large part of his time is spent in the packing shed, and the outside work on the farm tends to suffer, unless, of course, he is operating on a sufficiently large scale to employ a packing shed manager. Even so, and when packing is all that can be desired, the loads sent to market will be small compared with the thousands of cases of one grade arriving from abroad, and continuity of supply will be difficult to obtain.

Unless a grower has 150 to 200 acres of bearing apples, the cost per acre of storage and grading equipment may become an unduly large item. Where existing buildings have been

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adapted this is not so noticeable, but few orchards have buildings really suitable for the modern economic handling of fruit, and new buildings must be provided or drastic reconstruction of old buildings carried out after a few seasons.

Small grading machines working to less than 50 per cent. capacity, and the small storage plants found on farms from 30 to 50 acres are not economic. Equipment on such a holding could deal with the produce off double the area with comparatively little extra expenditure.

It will be seen that the preparation of fruit for market is developing into a specialized business, needing a large expenditure of capital, such expenditure being essential if remunerative prices are to be obtained. Instances are known in which individual farms have had more capital invested in storage and packing facilities than is represented in the value of the orchards.

For the majority of growers, the centralization of these operations in the production districts will offer the best and cheapest solution of their problems. Centralization enables grades to be standardized and a continuity of really uniform loads to reach the markets of the country day by day for months at a time. This is the only way in which competition of imported fruit can be met.

When centralization is carried out, it is possible to evolve an organization comparable to a modern factory, with its carefully planned collection, processing and distributive departments. An efficient costing system will be part of the office routine. This brings out the importance of over-head expenses, and shows clearly that these can only be lowered by obtaining the maximum possible bushelage of fruit passed through a plant of given size.

At first sight the packing costs may appear higher than those arising under farm conditions, in which, however, many charges are masked in general farm expenditure. The presence of these charges is not realized, and their magnitude is seldom brought out in terms of cost per bushel.

The trend of events and the several considerations above outlined led a few Essex growers who were faced with the problem of extending their packing plant and erecting stores, to undertake the formation of a Central Packing Station. Before this step was taken, investigations were made as to the history of previous co-operative marketing enterprises, and it was found that in most instances of failure this was due to

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the fact that members were not rigidly tied to the organization and wrecked the scheme by selling through outside channels.

A lawyer and an accountant were consulted and a suggested form of contract between grower and packing station was outlined. Their expert knowledge indicated many flaws, but as the result of several meetings a form of Contract was evolved that covered, as far as possible, all eventualities, and the most important of all would be enforceable in a Court of Law. Owing to its strictness the contract was unacceptable to several people who might have been interested. Nevertheless, four growers decided to form "Fruit Packers (Essex) Ltd." as a private limited liability company, operating a central storage and packing plant.

The salient points of the Contract are as follows:—

- (1) All apples and pears grown by signatories must be marketed through the Company for a term of years. If any breach of this occurs, strict penalties are enforceable.
- (2) The shares in the Company are issued against fruit acreage. Any new acreage acquired or planted must pay the same capital levy per acre as the original acreage. All areas with trees over 4 years old are taken as being equal. (Any other form of assessment becomes too complicated.)
- (3) A shareholder cannot dispose of his shares except to another fruit grower producing from an approximately equal area of land.
- (4) A shareholder shall not interfere with the internal working of the packing station; he can watch his fruit being handled, but any complaints or suggestions must be made in writing to the Secretary of the Company.
- (5) All sales of fruit of the same variety, size and grade are pooled. No individual grower's name appears on the market boxes. When any particular variety is finally cleared, the returns from all markets for each grade and each size are added together, and divided by the total number of bushels of that grade and size sent out. The grower is paid the average price for each grade and size on the number of bushels packed from his farm. There is no question of the good grower being penalized by the inefficient one.
- (6) Regarding gas storage—a separate pool price is worked on this fruit.

The wording of this clause is complicated and full details would take too much space in this article.

The idea of locating the packing station on the farm of one of the members was abandoned early, and a site was chosen situated as centrally as possible in the fruit area of Essex with rail and main road facilities, and 'bus services radiating in four directions. Buildings especially designed for the purpose were erected. It is interesting here to mention that very

A CENTRAL APPLE PACKING STATION

careful thought was given to working conditions of the operatives. Expenditure, which at one time was thought to be on the generous scale, was incurred in providing proper mess-rooms, washing facilities, central heating, etc. After one season's work this outlay has proved itself more than justified, since an excess of good class labour has come forward of its own accord, and in spite of the fact that numerous factories in the district are working at full pressure and that on the surrounding farms seasonal labour is extremely difficult to obtain. The wages paid are based on the agricultural rates.

The station is in charge of a full time manager who is responsible for the whole internal working, but this year at least two directors were present every day assisting with the organization, as packing commenced before the builders were out of the premises. Now initial experience has been gained this assistance will not be necessary in future years.

The Company arranges the collection of fruit from the farms through a haulage contractor. Although most of the farms are within a six-mile radius, fruit has been sent in from 30 miles away with no damage from bruising or loss of condition. Likewise the Company delivers the fruit to the markets.

In order to explain the handling of fruit an example will be taken for Grower X. He telephones to say that 200 bushels of Worcesters are ready for collection and another 300 bushels will be ready the following day. A lorry taking 150 orchard crates is sent as soon as convenient. The fruit is in the grower's own orchard crates all marked with his name. These are delivered into the reception bay of the packing station and stacked with a space left for the remaining loads to come and form one block.

In the meantime the packing station will be working on Worcesters from Grower Y. When these are finished, time will be given to partially clear the grader and see all packed boxes are stamped with the code letter for Grower Y, and an allowance made for the fruit remaining on the grader. This operation only takes a few minutes. Fruit from Grower X is then sent through from reception bay to packing shed where it passes over a Cutler Grader and is divided into four grades and various sizes. After being packed off the grader into the market containers, these are placed on a conveyor where the quality of packing is checked, and a slip placed on top giving packer's number and date of packing. The

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boxes proceed by gravity into the next room where lids are put on, and end stamped with Count, Date, Grade, and grower's Code Letter. From here another conveyor takes the finished article to the dispatch bay where the various grades and counts from each farm are stacked separately. On completion of this particular batch of fruit from Grower X a tally is made of all the various grades and counts, the quantities being entered into the grading day-book. From this book entries are made in the Grower's Ledger, and a statement is sent to the grower giving grading results.

SPECIMEN COPY OF GRADING SHEET

FRUIT PACKERS (ESSEX), LTD.

To: Grower X.

DATE 18/9/37

The undermentioned is a return of your Worcester Apples showing particulars as to grading.

DATE	EXTRA FANCY			FANCY			GOOD			3RDS		
	L.	M.	S.	L.	M.	S.	L.	M.	S.	L.	M.	S.
17/9/37	18	64½	24	12½	111	91½	13½	60½	41½	—	6	2½
TOTAL	18	64½	24	12½	111	91½	13½	60½	41½	—	6	2½

COUNTS

" L " LARGE 0-125.
 " M " MEDIUM 138-200.
 " S " SMALL 213- .

RECEIVED 500 ORCHARD CRATES.
 445½ BUSHELS PACKED
 (as shown above).
 4 BUSHELS, WASTE.
 6 BUSHELS, CULLS.
 44½ BUSHELS, SHORTAGE ON
 ORCHARD CRATES.

Remarks

Manager

1077

A CENTRAL APPLE PACKING STATION

Once a grower's fruit has been over the grader and a record taken, packages are bulked together with previously packed fruit. Consignments as far as possible in five-ton loads or over of special grades and sizes are made up to suit individual salesmen and markets.

As soon as returns come in from the salesmen, and have been checked, an interim payment is made to the grower. Final payment cannot be made until the variety is finally cleared, and pool prices for each grade and each group of counts have been worked out. With varieties selling over a long period a second interim payment will be made to the grower, based on an estimate of prices, and final payment on completion.

All fruit is divided into four grades, Extra Fancy, Fancy, Good, and 3rds. The first two are strictly in accordance with National Mark Standards and packed under the "Ace" Label. "Good" contains fruit that is on the border line of Fancy or slightly below, but free of progressive blemish. All these grades are box packed in Bushel Boxes; Half-bushel Boxes are not favoured, except for Cox's. The 3rds are marketed in salesmen's empties, failing a satisfactory cheap non-returnable container for low grades.

At the commencement of the season careful estimates are made of crops expected from the farms, and salesmen advised of approximate quantities they can expect. Specific markets are selected and regular supplies sent. If a market decided on falls below expectations, supplies are reduced, but not cut off. Salesmen are also consulted, and with their collaboration a programme for the ensuing week is drawn up, giving days of dispatch and almost exact quantities that will be sent. It is the Company's intention to keep the markets regularly supplied for 6 to 9 months of the year.

Fruit going into gas-store is sorted over a special grader, very large or damaged fruit being removed and marketed at once. Fruit for storage is wrapped in oil-papers and placed in special crates each marked with the grower's code letter. No final account is taken until the fruit has been brought out of store and passed over the Cutler Grader. No payment is made for any fruit until it has been actually sold and money obtained.

The Company, although formed independently of any County Association, is a member of the Associated Fruit Growers of Essex, Ltd., and, as previously stated, packs all suitable fruit under their label.

A CENTRAL APPLE PACKING STATION

SPECIMEN COPY OF PAYMENT FORM

FRUIT PACKERS (ESSEX), LTD.

To: *Grower X.*

DATE *28/10/37*

The undermentioned is a statement of prices realized
and amount due for *Worcesters*

BUSHEL			FANCY			GOOD			3RDS			TOTAL
EXTRA FANCY												
L.	M.	S.	L.	M.	S.	L.	M.	S.	L.	M.	S.	
18	64½	24	12½	111	91½	13½	60½	41½	—	6	2½	445½
Average price for whole season												
s. d. 8/7	9/9	9/-	8/1	8/10	6/9	4/9½	7/2	4/9½	4/1	4/8	3/2½	—

SUMMARY

445½ Bushels of *Worcester* £

Less.....per bushel

Packing charge .. £

Less advancement of

....per bushel .. £

N.B.—The above prices are
free of market charges and
salesmen's commission.

Cheque Total ..

For varieties that are not eligible for the National Mark a special label is used, but these only account for a very small proportion of the total bushelage handled.

As only one season's experience has been obtained, no more can be said on actual practice, but a few words may be devoted to contemplated future activities. Requests have been made this year from growers who require storing and packing facilities, but who are not prepared to supply capital,

A CENTRAL APPLE PACKING STATION

or tie the whole of their produce to the Company. If this demand is to be catered for on any scale, the original policy and financial structure will need alteration. The Company at present do not feel justified in doing this, or in putting up expensive equipment for fruit that may be diverted elsewhere. When accurate packing costs are known as the result of several seasons of working, steps may be taken to meet this demand with a modified contract. Additional growers are joining the Company as shareholders. It is intended to double the packing capacity of the station before next season. Should space be available, fruit from outside sources will be accepted, but this fruit must be packed under the Company's label and sold through its marketing organization.

In order to relieve the pressure on the packing plant during the Worcester season, a large cold store is being erected to hold fruit as it comes from the orchard, for short storage. This store will later in the season be used for Cox's or other varieties to be marketed before Christmas. The running expenses of this store will be treated as a general charge spread over all fruit handled.

In Essex conditions have been particularly favourable for the formation of a Central Packing Station, a large number of the orchards being young and the owners without specialized packing equipment. From this year's experience the writer sees no insurmountable difficulty to similar organizations being formed in other districts. Where farms have existing gas stores the fruit could be sent to a central station for packing and distribution. With prices pooled, however, the control and actual date of opening stores would have to rest with the packing station management.

Acknowledgement is made to the valuable assistance given by Messrs. Kirdford Growers, Ltd., and the Ministry of Agriculture and Fisheries, for supplying information that greatly helped in the formation of "Fruit Packers (Essex) Ltd."

THE CONTROL OF THE ONION FLY

D. W. WRIGHT, B.A.,

Horticultural Research Station, Cambridge

The larva of the Onion Fly (*Hylemyia antiqua* Meig.) is a serious and widespread pest of onions in this country. It is very common in gardens and allotments and in certain districts of intensive vegetable culture, where, as a result, onion growing may be almost an impossibility in some seasons. It occasionally attacks leeks and shallots but rarely causes appreciable economic losses in these crops. In Wales it has been recorded in tulip bulbs. The pest is well known on the Continent and since its introduction into North America it has become epidemic in certain localities. It attacks garlic grown for culinary purposes in Italy.

Life History. Observations made by the writer in the Eastern Counties suggest that the life history there is substantially similar to that worked out for the fly in Lancashire by Smith (1).^{*} The winter is passed in the puparial stage in the soil, from which adults emerge in early May. In the Eastern Counties this emergence is practically complete by the second week in June, the peak period extending over the last two weeks in May. Adults, arising from larvae of the first generation, again appear about the first week in July and reach maximum numbers in mid-July. From this time adults can be found continuously, but in varying numbers, until the second week in September. There appears to be a third peak emergence period in the latter half of August, and this, although smaller than either of the previous two, seems to correspond to the emergence of a partial third generation.

These emergence times and peak periods for adults should be regarded only as approximate, as they undoubtedly show some variation in relation to climate and soil conditions and to the availability of food.

Nature and Method of Attack. The adult flies do no injury to the onion plant, but obtain food from various small flowers. Dandelions are said to be frequently visited. Injury to the onion is brought about by the larvae or maggots, which

* For references see p. 1087.

CONTROL OF ONION FLY

bore into and feed in the base of the plant, reducing it to a rotting mass.

Eggs are laid either on the plant itself or in the soil close to its base. Observations suggest that on seedling onions the first generation of flies normally oviposits only in the latter position. The eggs of later generations are, however, commonly deposited on the neck and leaf bases both of seedling and larger onions, whence they are easily dislodged without affecting their viability. The larva, on hatching, makes its way down to the base of the onion plant and enters it at, or very near to, the basal plate, where the tissues are not protected by a tough skin. It seems unable to penetrate the side of the bulb. Migration of older larvae to fresh plants often occurs and then entry may take place either through the side of the bulb or through the base. This migration is a feature of the attack on seedling onions, and when the underground parts are destroyed the tops turn yellow, fall over and die. Large bulbs may contain as many as 20-30 larvae and the tissues are rapidly reduced to a semi-liquid rotting mass upon which the larvae continue to feed. When fully fed they burrow into the soil and change into oval puparia, which become chestnut-brown in colour.

Methods of Control. Considerable attention has been devoted to the control of this pest both in Europe and North America. The control measures advocated can conveniently be classified into four groups:—

- (a) The use of deterrents to prevent egg laying;
- (b) Trapping and killing adults by poison baits;
- (c) The use of larval poisons; and
- (d) Cultural measures.

The first category includes, among other materials, powdered naphthalene, tar oil-sand mixtures, chlor-cresylic acid dusts and paraffin emulsions. All have been shown to give some degree of control but have not been widely used. Light engine oil, emulsified in 4 : 4 : 50 Bordeaux mixture and applied at 2 per cent. oil strength, is, however, extensively used in North America. A great defect in the use of all deterrents is the necessity for their constant renewal. Further, when certain of these compounds are applied over a large area, the adult flies appear to become accustomed or "conditioned" to their presence and suffer little inconvenience from them.

Poisonous baits, together with chemical attractants, have been used with some success in climates more arid than in

CONTROL OF ONION FLY

Great Britain. Their use here, however, has not been attended with much success and could scarcely be relied upon, chiefly on account of the uncertain nature of weather conditions in the average summer.

Among larval poisons used, various mercury salts have been found to give a considerable degree of control. Corrosive sublimate solution, periodically watered along the rows, is reputed to be effective, but its use is attended with some danger to user and plant. These dangers are greatly decreased by the use of powdered calomel, which may be applied to the seed coat before sowing or sown separately in the seed drills, the plant being tolerant of quite heavy applications. Satisfactory control of heavy infestations of this pest and other root maggots has been obtained in this way. (2, 3, 4 and 5.)

Cultural operations, although of little value alone in combating heavy infestations, are undoubtedly efficacious in dealing with minor attacks. Valueless onions should be buried deeply and not dumped in the field, for such favourable breeding material leads to the rapid building up of a high fly population. Late planting to avoid attack by the first generation is of some value, while applications of inorganic nitrogenous fertilizers enable a crop to grow away and recover from minor infestations. Finally, onions should be grown as far as possible from land known to be infected.

Experiments in 1936. In 1936, preliminary experiments were carried out with certain of the above deterrents and larval poisons with the object of assessing their relative value under climatic conditions here.

Chlor-cresylic acid dust (1 per cent.) applied three times at ten-day intervals, using quite heavy dressings, gave slight reduction of infestation. A *light engine oil-Bordeaux emulsion*, applied at 2 per cent. oil strength and at ten-day intervals, gave good control of onion maggot, but owing to its phytocidal action, the number of plants on these plots at the end of the experiment was of the same order as that on the untreated plots which had suffered a fair degree of maggot injury. Plots planted with seed *austed with calomel powder*, however, suffered very little injury from the maggot. Further, this chemical appeared to have no deleterious effect on germination or subsequent plant growth. The final number of plants on these plots was much higher than in any other series in the experiment. Calomel, when applied along the drills as

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a 4 per cent. dust, gave a much poorer control than as used above, although the amount of calomel used per unit length of drill was greater. Soaking the rows with corrosive sublimate solution (1 oz. to 10 gallons of water) three times at ten-day intervals gave little control of maggot.

Experiments in 1937. In the spring of 1937 a more extensive series of plots was laid out, and the treatments carried out in the previous year were repeated and extended by the inclusion of an additional series of seed treatments. The latter included lead arsenate dust and a range of organic mercury compounds, all applied to the seed coat before sowing. In mid-May, at the peak time of emergence of the first generation of flies, the seedlings were $1\frac{1}{2}$ to 2 in. high. At this phase they are very attractive to the flies and very susceptible to injury from their larvae. The following table expresses in summary the details of the several treatments used, their times of application and the degree of control obtained from each.

TABLE I
CONTROL OF ONION FLY, CAMBRIDGE, JULY, 1937

<i>Treatment</i>	<i>Method of Application</i>	<i>Dates of Application</i>	<i>July 8 % Original Plants remaining</i>
1. Control	—	—	37.0
2. Calomel	Seed dust ..	April 22 at sowing	91.5
3. Lead Arsenate ..	"	" "	34.2
4. Methyl Mercury Phosphate 1% at $\frac{1}{4}$ lb. per bushel seed.	"	" "	31.6
5. Methyl Mercury Phosphate 3% at 2 lb. per bushel seed.	"	" "	26.3
6. Corrosive Sublimate	Solution at 1oz. per 10 gallons water.	May 15, 25 and June 2	45.1
7. Chlor-cresylic Acid ..	1% dust	" "	36.6
8. Engine Oil-Bordeaux Mixture.	2% Emulsion in 4 : 4 : 50 Bordeaux	" "	45.2

As in 1936, corrosive sublimate and chlor-cresylic acid treatments had little effect on the extent of the infestation. The engine oil-Bordeaux spray gave less maggot control than in 1936. Again the plants were stunted and their number reduced. This scorching has been noticed in North America, and is thought to be correlated with conditions of high humidity and low temperature at and following the spray

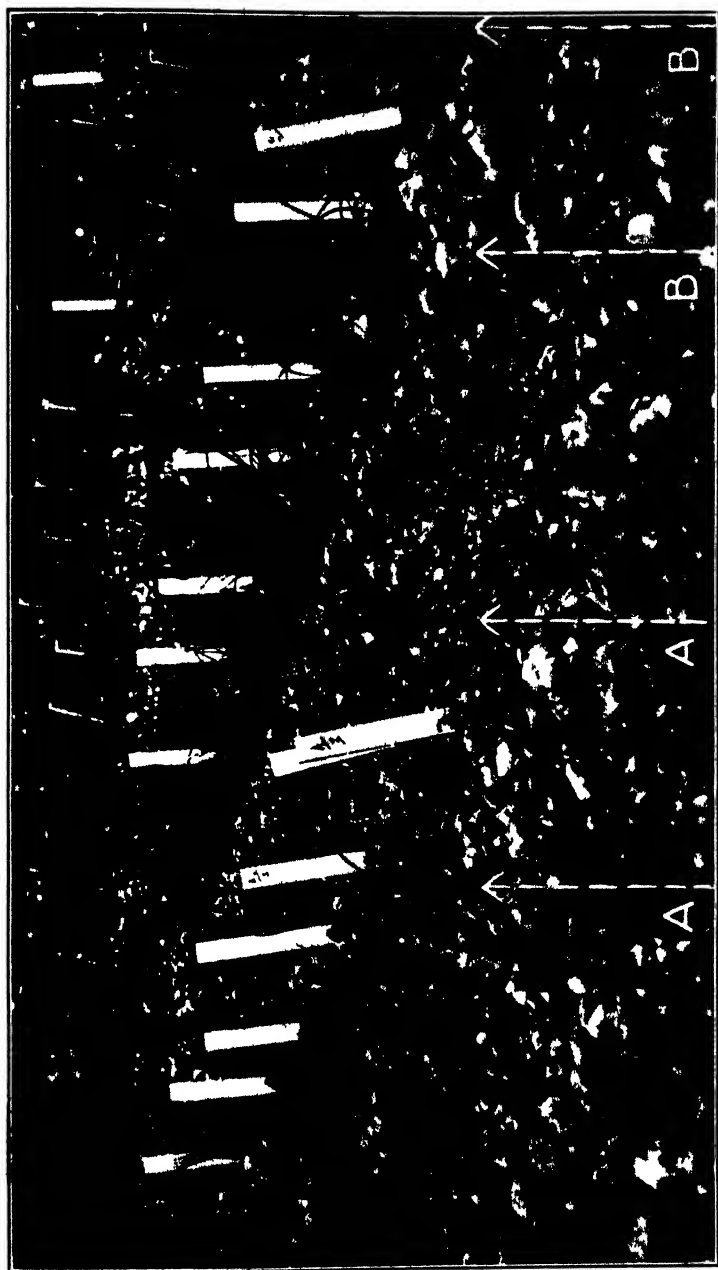


FIG 1.—Control of Onion Fly with calomel. Rows marked A untreated (controls) Rows marked B grown from seed treated with 1 lb calomel to 1 lb seed

CONTROL OF ONION FLY

applications. A proprietary light oil emulsion, used at the same strength and time intervals produced a similar effect. This appears to indicate that such oils are unsafe to use on onions under the climatic conditions of Great Britain.

The plots in which the seed was treated with calomel were again outstanding, as the characteristic feature of maggot attack, namely gapping, was absent. In carrying out this treatment the seeds, after being first damped with a 5 per cent. solution of a *proprietary adhesive paste containing starch* were agitated in a vessel with finely-powdered calomel. By this means the seed becomes heavily coated with powder, one pound of seed easily retaining an equal weight of calomel. It was used at this rate in the above experiment. Adherence of the powder to the seed remained good whilst being handled at sowing. Germination and subsequent plant growth seemed in no way affected by this treatment. The organic mercury compounds, methyl mercury phosphate and methyl mercury chloride were used as seed dusts (with an inert carrier) at strengths and dosages ranging from 1 per cent. dust at the rate of $\frac{1}{2}$ lb. per bushel of seed to 3 per cent. dust at 2 lb. per bushel of seed. There was no evidence of any degree of maggot control over the whole range, while, except at the lower rates of application, germination was greatly impaired. Lead arsenate applied to the seed coat in the same manner and at the same rate as calomel was of no value.

In July, 1937, a series of randomized plots was laid out to test more closely the value of calomel when used at different rates. The powder was applied to the seed coat as before, but at two rates, namely $\frac{1}{2}$ lb. per 1 lb. of seed and 1 lb. per 1 lb. of seed. From counts of seedlings in unit lengths of row, taken both before and after infestation, the percentage of healthy plants shown in the table was calculated.

TABLE II
CONTROL OF ONION FLY, CAMBRIDGE, SEPTEMBER, 1937

Treatment	% Healthy Plants remaining	% Increase over Control
1. Control	22.1	—
2. Calomel at $\frac{1}{2}$ lb. per 1 lb. seed	50.6	129
3. Calomel at 1 lb. per 1 lb. seed	69.2	213
Standard Error of Mean ± 3.361 .		

Statistical examination of the results revealed that the calomel treatment at 1 lb. per 1 lb. of seed was significantly

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better than the half dose, and both were significantly much better than the non-treatment (see Fig. 1). A slight attack of cutworm and wireworm reduced the final number of plants by about 5 per cent., but this damage appeared to be distributed fairly uniformly over all the plots and did not therefore appreciably affect the significance of the final figures in relation to onion fly control.

Recommendations. *Equal weights of calomel and onion seed* give satisfactory control. In treating the seed the following procedure is recommended.

(1) A dilute solution (approx. 5 per cent.) of *adhesive paste* is prepared by adding *liquid adhesive paste*, as purchased, to water at the rate of 14 grammes or 3 teaspoonfuls per $\frac{1}{2}$ pint of water. Thorough stirring to ensure complete mixing is necessary.*

(2) The onion seed to be treated is placed in a suitably sized wooden, glass or enamel container. (Metal containers should not be used as calomel tends to corrode these.)

(3) The diluted *paste* solution is then added at the rate of $3\frac{1}{2}$ c.c. or $\frac{3}{4}$ teaspoonful per ounce of seed, or 56 c.c. ($3\frac{1}{2}$ tablespoonfuls) per lb. of seed. The seeds are then thoroughly stirred until all are moistened.

(4) Powdered calomel, equal in weight to the seed, is then added, and the whole mixed until the seeds are uniformly coated with powder.

The treated seed can be handled immediately or allowed to dry without loss of calomel. If an excess of *paste solution* is used, a sticky mass results making even sowing almost an impossibility.

The seed bed should be firm, as this not only favours good germination and subsequent plant growth, but also tends to reduce the number of seed coats brought above ground. Those remaining in the soil keep the calomel near the base of the plant where it appears to exert its toxic action on the larvae.

* Although not actually used in these experiments, starch or flour pastes appear to stick the calomel to the seed quite as well as the proprietary compound. A suitable paste solution can be made by adding starch powder or flour to cold water at the rate of 8 grammes (3 teaspoonfuls) per $\frac{1}{2}$ pint of water. After shaking, the mixture is brought to the boil and when cool is used for damping the seed in quantities similar to those recommended above for the diluted proprietary compound.

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At current prices calomel can be obtained at 8s. per pound, but quotations are often considerably above this.

Summary. (1) The life history of the onion fly (*Hylemyia antiqua*) as observed in the Eastern Counties is briefly given.

(2) The site of egg deposition and the initial and subsequent methods of attack by the larvae are described.

(3) The control measures used in Europe and North America are briefly reviewed.

(4) Experiments involving the use of deterrents and larval poisons are described. Satisfactory control of maggot was obtained by the use of calomel powder applied to the seed before planting.

(5) A statistical analysis of results obtained from the use of calomel at two rates on a series of randomized plots gave highly significant results.

(6) A method for treating the seed is outlined.

The author is much indebted to Mr. D. Boyes, Director of the Horticultural Research Station, and to Mr. F. R. Petherbridge of the School of Agriculture, for valuable suggestions and criticisms.

The above experiments and observations were carried out at the Horticultural Research Station, Cambridge.

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A PRELIMINARY INVESTIGATION INTO THE OCCURRENCE AND CAUSES OF HAIR CRACKS IN HEN EGG SHELLS

R. COLES, B.A., Ph.D.,

Ministry of Agriculture and Fisheries

The candling of eggs at the many packing stations in the country has revealed that large numbers of eggs are rejected because of fine cracks in the shell. These shell faults have been named both "air cracks" and "hair cracks," but it is proposed to call them hair cracks in the following account. There are two reasons for rejecting eggs with this fault. First, the faulted shell appears to induce rapid deterioration of the egg—in the summer, a great number of rejects found in recently-packed consignments are eggs with "hair cracks," in which the stuck yolk is adhering to the shell in the vicinity of the fine hair-like fault. Secondly, an egg with a cracked shell, however slight the crack, collapses at the first shock, with results that spoil the appearance of the pack, and, in hot weather, lead to the rapid deterioration of the surrounding eggs.

It has become apparent from observation of large numbers of eggs passing through packing stations, that an unusually high percentage of eggs are—and rightly—rejected at certain packing stations owing to the presence of hair cracks. Indeed, it is known that several packing stations, realizing the dangers arising from the inclusion of these eggs in a pack, reject them, but do not show the full number of eggs rejected through fear of losing the supplier. This unfortunate position suggests that the cause of these hair cracks should be sought and the remedy found. This article gives an account of the preliminary investigation.

A superficial investigation of the collection methods at present practised makes it obvious that many hair cracks are caused by these methods. Cheap metal buckets are often filled to their capacity, with the result that, when the full bucket is raised, the bowing of the sides under the weight of the eggs causes excessive pressure to be brought upon the lowermost eggs. Rough transport provides a further reason for the presence of cracked eggs. It is doubtful whether pro-

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ducers fully realize that careless handling and transport often account for the majority of faulty eggs rejected at the station.

A large number of hair cracks that the testers fail to note are apparently caused by faulty graders, and an inefficient staff may also allow eggs to roll about on the grading table, particularly if the grading tables have, through wear, acquired an excessive slope.

During the course of the investigation it soon became apparent, however, that a large number of hair cracks could not be attributed to the causes enumerated above, but that certain eggs were apt to crack with normal handling. These eggs had shells that easily cracked owing to their excessive brittleness or to some other shell peculiarity. Indeed, certain suppliers, although taking the greatest care with their collection and delivery, maintained an excessively high percentage of eggs rejected with hair cracks—often as many as 10 per cent., whilst other suppliers, adopting much more primitive methods of collection, had very few eggs rejected for this fault, in many instances as few as 1 per cent.

Before proceeding further in the investigation it would be as well to consider some of the experimental work that has already been carried out regarding shell strength. The Northern Irish investigators (1)* maintain that (a) shell quality does not show a significant variation due to changes in management or rations, (b) the more common breeds do not show significant differences in shell strength, (c) the greatest variation is between individual birds, and (d) the relation between shell strength and keeping quality is slight. It must be borne in mind, however, that the shells were only subjected to steadily increased stress, and not to sudden shocks.

In America, Van Wagener and his colleagues maintain that there is no significant variation in shell strength between the eggs of certain common breeds (2).

Opposed to these views is the opinion amongst a number of producers and packers that certain producers' eggs crack readily if subjected to slight shocks, and are even produced with hair cracks, or lines of weakness that quickly become hair cracks. Examination of packing station figures certainly shows that the percentage of eggs rejected for hair cracks varies locally. On the basis of this evidence it has been suggested on several occasions that there is some constitutional reason for the presence of hair cracks, which, in spite of the

* For references see p. 1094.

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evidence offered by U.S.A. and Northern Ireland, may be connected with feeding, management or breed.

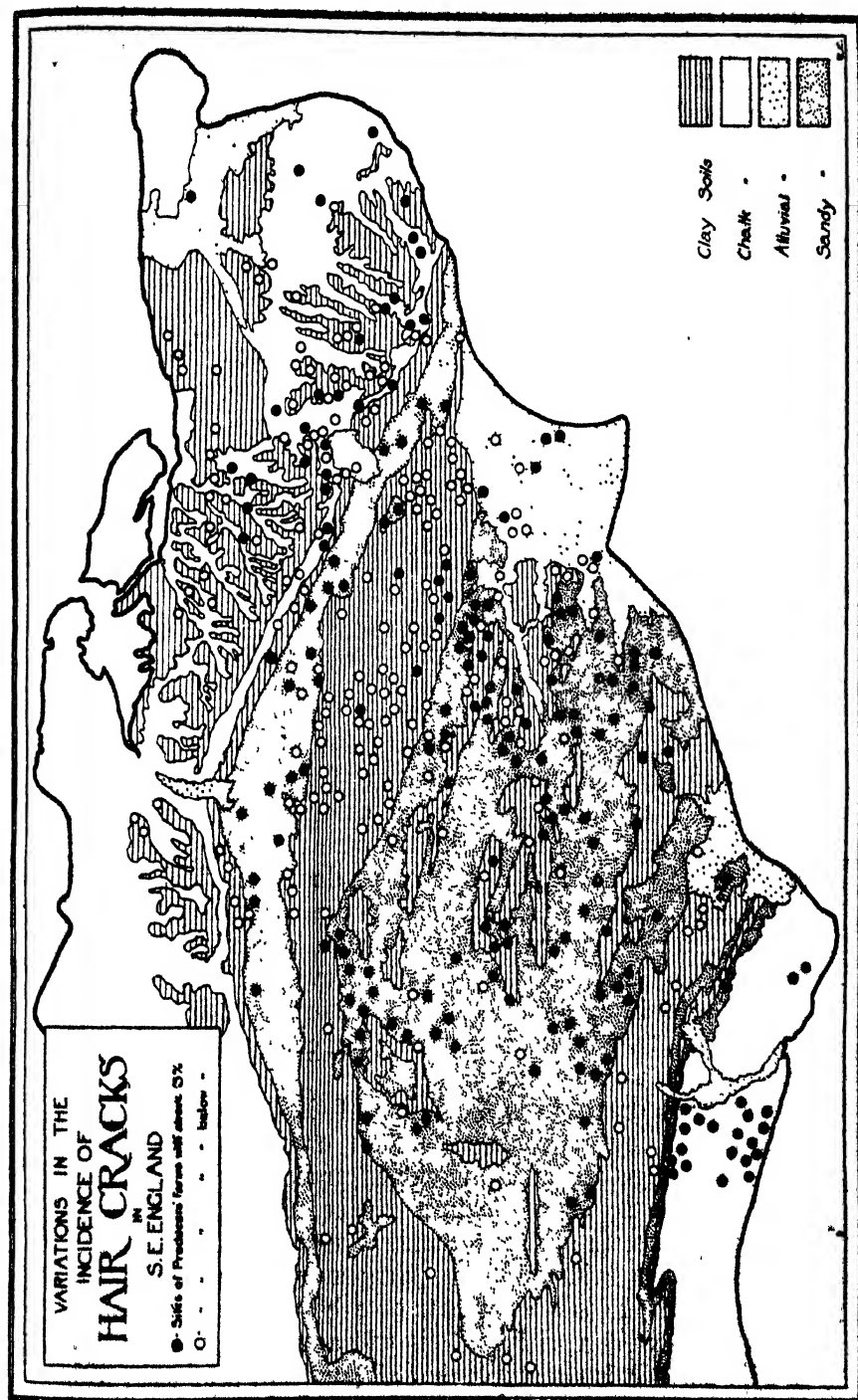
South-Eastern England. In order to throw some light on these contentions, an investigation was made in an area where the hair crack figures showed remarkable differences regarding the number of eggs rejected for this fault. The area selected was the south-eastern part of England.

In Fig. 1 is shown the variation in the numbers of cracked eggs rejected by the packing stations of the area. The dots and circles shown indicate the sites of the producers' farms; the dot denoting a percentage above three, the circle a figure below three. The figures were obtained from thirteen National Mark stations and other satisfactorily run stations in the area, and relate to consignments of at least a few hundred dozen, although in a few instances consignments as low as forty dozen have been used. When the pattern in the figure became apparent, several producers' figures were inspected for the entire year. It was found that, although a certain seasonal variation obtained, it was unnecessary to change the distribution shown in Fig. 1, which is for the month of April.

An inspection of Fig. 1 reveals a definite distribution pattern. To the north and south, i.e., the Downs, the percentage of eggs rejected for hair cracks is high, although this fact is perhaps more definite in the south than the north. It is also noticeable that the country south of the North Downs is a further area producing eggs with a tendency towards hair cracks, particularly around Maidstone and Ashford and the intervening tract. The centre of the district also appears to be a terrain with a high percentage of eggs subject to hair cracks, but it will no doubt be remarked that the localization is not so distinct as in the two regions dealt with above. Towards the east it is difficult to distinguish any district having a definitely high or low percentage. Finally, a broad belt of country extending in horse-shoe-like fashion throughout the area may be discerned with the front lying towards the west. Throughout this tract producers having a high percentage of hair cracks are rare indeed.

In describing this distribution it will not have escaped readers that the pattern appears to be related directly to the relief of the country. On this evidence one might reasonably contend that the cause of the hair cracked eggs is the rough

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ground over which the conveyance collecting eggs must travel. This argument, however, can be defeated quite easily by the fact that eggs from certain low-lying areas have to come across upland areas. Although this regional cause of hair cracks does not appear to be tenable, it is worthy of notice that there is a strong relationship between the relief, the soil and the cultivation of the area.

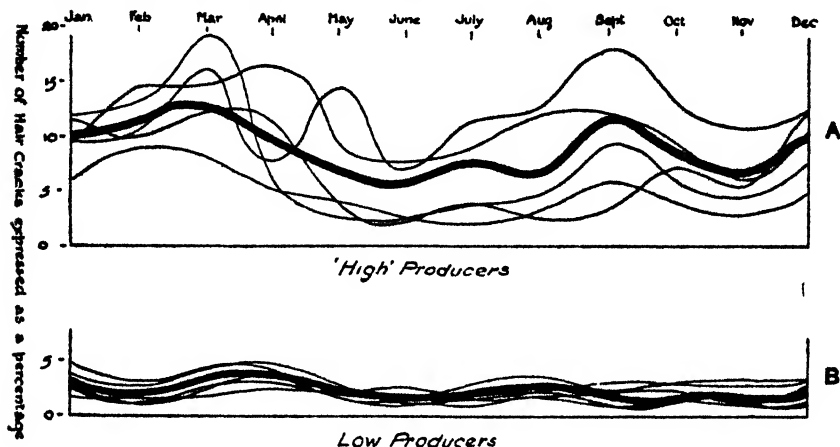


FIG. 2.

Before proceeding further along these lines, it is proposed to investigate more fully the figures of certain selected producers and to note any seasonal changes. In Fig. 2A is shown a graph formed by the average monthly figures for cracked eggs experienced by six producers having a high percentage of hair cracks. The curves of individual producers are also shown. It is at once apparent that two maxima are characteristic of each curve. These maxima appear at February-March and at September, but it will be noticed also that curves rarely fall 3 per cent. and that 10 per cent. is the average figure.

The graph drawn from the figures of similarly-selected producers with low percentages of hair cracks is also shown (Fig. 2B), together with individual producers' curves. In this diagram no strong feature can be discerned, although in a slight measure the two maxima noticed in the curve of the producers with high percentages of hair cracks are repeated. It is also interesting to note that the double summer-autumn maximum of Fig. 2A is still apparent in the curve in Fig. 2B. It is noticeable that all curves of producers with low percentage of hair cracks rarely rise above 3 per cent.

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These figures of individual producers—chosen because of the large quantities of eggs they consigned—were found to be characteristic of other poultry farmers shown as producers with high or low percentages of cracks in Fig. 1. It therefore seems a reasonable assumption that certain producers do constantly have a large number of eggs that easily crack, or in which these cracks appear. Further, other producers are rarely bothered with these faults, although both they and the producers who are troubled with eggs containing a high percentage of hair cracks show a seasonal variation—a variation that is very definite as regards the latter. There also appears to be a definite localization of the two types of producer in the area treated (S.E. England), which has a direct relationship to the relief of the area.

Three Other Districts. In view of these features that are apparent in S.E. England it was thought advisable to investigate conditions elsewhere and attempt to find confirmation or otherwise of these characteristics. Three districts were selected—the Midland Valley, Essex and the South-west.

The grading centres of the Midland Valley and the South-west showed a very low hair crack percentage—below 3 per cent. The Essex area showed both types, and again the eggs with the high percentage of hair cracks appeared in the upland areas—the hilly country of the north-west and the south-east. In all the figures investigated that related to a high percentage of hair cracks, the two seasonal maxima were easily discernible. In passing, it was also interesting to note that the eggs from the districts of low percentages were usually richer, darker in yolk colour, and darker in shell, but lacked the compensating high keeping quality of the eggs of the “hair crack regions.” Further, “forcing” and poultry farms with high average annual production of eggs, were more characteristic of the latter districts, while free range and farm-yard poultry were predominant in the former districts. The fact that most packing stations report about 3 per cent. or more cracks in their annual turnover, suggests that 3 per cent. may be the working minimum, and represents the average breakage figure incurred by collection and grading.

Chemical Composition. The figures obtained from various packing stations having been dealt with, the chemical and physical nature of egg-shells from producers both subject to

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and free from, hair cracks were considered. The chemical analyses (3), however, showed that, apart from slight variations, the chemical composition was reasonably constant. The amount of certain minerals found in certain shells appeared to be too small to affect the breaking strength of the shell. Two variations of importance were observed. The protein matrix of the shell varied, and the water content varied, but the variations were small, and the most significant factor appears to be the physical distribution of the two materials. In order to investigate their distribution, shells with and without hair cracks were tested by the candle, and small sections were examined under the microscope.

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(To be continued.)

THE WORKING OF THE SEEDS ACT, 1920, IN THE SEASON 1936-37

The steps taken by the Government to assist farmers to increase the fertility of their land by reimbursing a substantial proportion of the delivered cost of their supplies of lime and basic slag (see "The Land Fertility Scheme" in the October, 1937, issue of this JOURNAL) are being followed up by an official campaign for the improvement of grass land. Excellent results follow the application of basic slag, and also lime, where lime is needed, to grass land, but in certain circumstances it is clearly desirable that the pastures should be ploughed out and re-seeded. In purchasing supplies of seeds for this purpose, farmers have a valuable safeguard as to the quality of the seed in the Seeds Act, 1920, the main object of which is to protect them against the danger of unknowingly purchasing and sowing seeds of low vitality and contaminated with noxious weed seeds. Assistance in selecting the right kind of seeds mixture is given to the farmer in other ways,* and it is noticeable that merchants are beginning to stock indigenous and Aberystwyth-bred seeds and offer the mixtures advocated by agricultural colleges and county agricultural organizers. In his own interests, however, the farmer should himself examine carefully the essential particulars as to the quality of the seed, country of origin, &c., which the Act of 1920 requires the seller to disclose to him in writing on or before delivery of the seed.

Similarly as regards other seeds, cereals and the other principal kinds of farm and garden crops, the Act requires the seller to disclose essential details as to their germination, purity, and other matters relating to their quality, and it repays the farmer to give attention to these particulars. These requirements of the Act extend to sales of seed from farmer to farmer, and it is as necessary for the purchaser to be certain that he is supplied with the statutory particulars, and that careful consideration should be given to them, when seeds are obtained in this manner as when they are purchased from a seedsman.

* A revised edition of the Ministry's Bulletin No. 3, *The Improvement of Grass Land*, will be issued at an early date.

THE WORKING OF THE SEEDS ACT: SEASON 1936-37

A convenient summary of the provisions of the Act of 1920 and the Regulations made thereunder (Form No. 728/C.S.), showing also the fees charged for testing at the Official Seed Testing Station and other useful information as to the drawing of samples for testing, may be obtained free of charge on application to the Ministry at 10, Whitehall Place, London, S.W.1.

The administration and enforcement of the Act are matters for which the Ministry is solely responsible, and during the course of the 1936-37 season Inspectors of the Department made numerous visits to sellers of seeds throughout the country. Apart from certain recurring minor irregularities, it is evident from the reports on these visits that the requirements of the Act are being carried out generally in a satisfactory manner.

One of the irregularities to which, owing to its increased practice, attention might be called, is that of delaying the issue of the statutory statement until some time after the seeds to which they refer have been delivered. The Act requires that this statement shall be delivered "on or before the sale, or if the goods are not delivered at the time of sale, on or before delivery thereof." Moreover, it is clearly desirable that the purchaser should be in a position to examine these particulars before he sows the seed. The difficulty which seedsmen may have at the height of a busy season in complying with this requirement is appreciated, but if it is found that this practice of delaying the issue of the statutory statement under these circumstances is giving rise to abuse, it may be necessary for proceedings to be taken against the offenders.

A noticeable feature of the seed trade of to-day is the steady diminution in the number of the smaller houses which at one time did a business in agricultural seeds. The points at which the Ministry has been accustomed to tap the farmers' supply of seed are, therefore, lessening in number. The position is not analogous to the packet trade where the retailer is an agent who carries goods that can be officially sampled. With agricultural seeds it appears that the former retailer is frequently becoming an agent selling on commission. In these circumstances it has been found necessary for the Ministry to extend its practice of checking supplies informally on the farm.

THE WORKING OF THE SEEDS ACT: SEASON 1936-37

Control Sampling. The number of samples taken during the 1936-37 season for the purpose of checking the particulars declared on the sale of seeds was 1,255. They comprised 443 samples of grasses and clovers, 113 cereals, 116 field seeds (other than sugar-beet), 281 "loose" garden seeds, 235 packeted seeds, and 67 sugar-beet seeds.

Farm and Garden Seeds. It was found necessary to draw attention to 78 instances of discrepancies in the particulars declared and to 44 incomplete or irregular declarations. Of the 78 discrepancies, 20 were in respect of purity and 58 of germination. Stated as percentages, the figures show that 9.7 per cent. of the total samples called for special attention, 1.6 per cent. in regard to purity and 4.6 per cent. owing to germination discrepancies, while the remaining 3.5 per cent. were instances of omissions from, or errors in, the declaration.

As regards the purity discrepancies, 10 samples came within 3 per cent. of the declared figure, 2 showed a variation of between 3 and 5 per cent., and 8 exceeded 5 per cent. With regard to the germination discrepancies, 16 samples showed a variation of less than 10 per cent., 18 others varied by less than 15 per cent., leaving 24 in which the difference between the germination declared and that found in the check tests amounted to more than 15 per cent.

Grass and clover seeds, which showed 9 discrepancies in purity and 38 in germination, were responsible for nearly two-thirds of the total number of discrepancies. Garden seeds necessitated action in 14 instances, there being 4 purity and 10 germination discrepancies. Field seeds accounted for 5 other discrepancies in purity and 2 in germination, cereal seeds for 2 in germination, while packeted seeds showed 2 discrepancies as to purity and 6 as to germination.

Private Licensed Seed Testing Stations. Periodical visits were paid by the Ministry's Inspectors to the 79 stations that are specially licensed to conduct tests for the purpose of making the statutory declaration in respect of the licensee's sales. The purpose of these visits was to examine the station's records and equipment and to select "Reserved Portions" (duplicate samples of seeds tested by the stations) for check testing at the Official Seed Testing Station, Cambridge.

THE WORKING OF THE SEEDS ACT: SEASON 1936-37

Altogether 1,198 "Reserved Portions" were obtained and in 98 of these the difference between the results obtained at the Station and the check test at the Official Seed Testing Station exceeded the amounts allowed in the limits of variation prescribed in the Seeds Regulations, 1922. Fourteen of these samples were of red clovers in which a decrease in the germination percentage was more or less balanced by an increase in the number of hard seeds. Apart from these 14 samples, there was a total of 84 discrepancies, which represents approximately 7 per cent. of the "Reserved Portions" taken during the season, as compared with 111 discrepancies or 8 per cent. of the samples taken during the season 1935-36. On the whole, therefore, the work of the licensed stations this season may be said to have been carried out in a very efficient manner.

Seed Potatoes. The Seeds Act requires that every purchaser of seed potatoes shall be given particulars in writing as to the (1) name and address of seller, (2) class, viz., either "Class 1 (Scotch)," "Class 1 (Irish)," "Class 1 (English Special Stock)," "Class 1 (Welsh Special Stock)," "Class 1 (English once-grown)," or "Class 2"; (3) name of variety; and (4) size and dressing. The Wart Disease of Potatoes Order of 1923 also requires that the number of the official certificate issued under that Order shall be given.

Considerable attention is given by inspectors to the enforcement of these requirements, and during the period under review 9 instances of misdescription of variety were investigated (4 of which concerned Scottish sellers and 3 Northern Irish), 17 instances of false particulars of size and dressing (of which 12 were in regard to Scottish sellers), and one instance of false statement as to "class." In three of the above instances and in three others the requisite statutory statement had not been given to the purchaser or was incomplete in respect of one or more items.

Prosecutions. The only prosecutions instituted during the year were in respect of seed potatoes. In one instance a Birmingham merchant supplied a local farmer with a considerable quantity of seed that was alleged to be Irish certified stock. Following a complaint by the farmer, an inspection of the resultant crop, which was practically worthless and involved the farmer in heavy financial loss, revealed that the seed was not of Irish origin. It was eventually decided

THE WORKING OF THE SEEDS ACT: SEASON 1936-37

that the most appropriate charge, having regard to the magnitude of the offence, would be under the Larceny Act, 1916, for obtaining money by false pretences, rather than under the Seeds Act, 1920, and the Wart Disease of Potatoes Order, 1923. The prosecution was undertaken by the Birmingham City Police and the defendant, pleading guilty, was fined in all £50 with £5 5s. 0d. costs.

In the other instance a Lincolnshire potato merchant was prosecuted under the Seeds Act, 1920, for making a false statement as to the variety of seed sold. The defendant pleaded guilty and was fined £2 0s. 0d. with £6 5s. 0d. costs.

MARKETING NOTES

Milk Marketing Scheme. The wholesale price for liquid milk (other than Tuberculin Tested milk) in December, 1937, was 1s. 6d. per gal. the same as in the previous month, but 1d. more than in December, 1936. The wholesale price for Tuberculin Tested milk in December, 1937, was 1s. 8d. per gal., the same as in the previous month.

Pool prices for December, 1937, are given below, with comparative figures for November, 1937, and December, 1936.

				<i>Pool Prices</i>		
				<i>Dec.</i>	<i>Nov.</i>	<i>Dec.</i>
				<i>1937</i>	<i>1937</i>	<i>1936</i>
				<i>d.</i>	<i>d.</i>	<i>d.</i>
Northern	..	..	..	15½	15½	14
North-Western	..	..	..	15½	15½	14
Eastern	..	..	..	16	15½	14½
East Midland	..	..	..	15½	15½	14½
West Midland	..	..	..	15½	15	14
North Wales	..	..	..	15½	15½	14
South Wales	..	..	..	15½	15½	14
Southern	..	..	..	16½	15½	14½
Mid-Western	..	..	..	15½	14½	14
Far-Western	..	..	..	15½	14½	13½
South-Eastern	..	..	..	16½	15½	14½
Unweighted Average	..	..	..	15·64	15·30	14·14

These prices are exclusive of any premium for special services and level deliveries, and also of the quality bonuses for Accredited and Tuberculin Tested milks. The estimated gallonage on which the quality bonuses were paid was 29,190,725.

The inter-regional compensation levy was fixed at 1d. per gal. compared with 1½d. per gal. in December, 1936. Sales on wholesale contracts were as follows:—

				<i>Dec., 1937</i>	<i>Dec., 1936</i>
				<i>(estimated)</i>	
				<i>Gal.</i>	<i>Gal.</i>
Liquid	..	..	..	51,257,559	47,302,947
Manufacturing	..	..	..	12,851,151	16,310,319
				<hr/>	<hr/>
				64,108,710	63,613,266
				<hr/>	<hr/>
Percentage liquid sales	..	..	..	79·95	74·36
Percentage manufacturing sales	..	..	..	20·05	25·64

The average realization price of manufacturing milk during December was 7.67d. per gal. compared with 6.25d. per gal. for December, 1936. The quantity of milk manufactured into cheese on farms was 660,220 gal. compared with 938,576 gal. in the previous month and 428,146 gal. in December, 1936.

MARKETING NOTES

Hops Marketing Scheme: *Committee of Inquiry.* In accordance with an undertaking given in Parliament when the Amendments to the Hops Marketing Scheme were being considered in 1934, the Minister has appointed a Committee of Inquiry to review the operation of the quota provisions of the Scheme, which are due to expire on July 31, 1939, and to make recommendations in the light of the experience of the past few years as to the desirability of retaining the quota provisions in the Scheme with or without modifications, due regard being paid to the interests of hop growers, brewers, and any other persons affected by the Scheme, and to the public interest.

The members of the Committee are Mr. A. W. Cockburn (Chairman), Mr. A. F. Forbes and Mr. T. W. Haward. The Secretary is Mr. R. G. R. Wall, of the Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1, to whom all communications should be addressed.

Potato Marketing Scheme. As the outcome of discussions of matters of mutual interest between the National Federation of Fish Friers, Ltd., The National Federation of Fruit and Potato Trades, Ltd., and the Potato Marketing Board, a tripartite committee consisting of four representatives of each organization was set up in September last to explore proposals for long-term contracts between producers, authorized merchants and fish friers for the supply of potatoes at uniform prices. The Committee have now issued a report in which they state that they are agreed that long-term contracts between individuals for periods of two years or more are feasible, but that they think there is little prospect of any immediate general adoption of collective contracts amongst producers, merchants or fish friers for securing group responsibility for delivery or payment. The Committee feel that contracts must depend upon individual initiative and negotiation, and they do not think scales of prices could be indicated for the benefit of those making contracts; but they recommend that the several organizations should assist with their advice in the drawing-up of long-term contracts and encourage the scheme generally and that specimen contracts should be made available.

The Committee further record their view that a tripartite committee appears to be a satisfactory medium for reconciling the views of their respective organizations, and suggest that, if their recommendations are adopted, a permanent committee

MARKETING NOTES

should be established (a) to watch the development of long-term contracts between producers, merchants and fish friers, and (b) to provide a means for discussing trade problems affecting the three parties.

Milk Acts, 1934 to 1937: Milk-in-Schools Scheme. The following figures show the monthly gallonage of milk consumed in each of the first three years of the scheme:—

		1934-35	1935-36	1936-37
		<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
October		1,972,482	2,273,178	2,225,782
November		2,449,037	1,951,731	2,199,597
December		1,772,019	1,562,954	1,797,285
January		2,174,888	1,901,625	1,640,373
February		2,347,855	2,052,243	2,157,355
March		2,388,857	2,305,192	2,045,251
April		1,649,039	1,547,537	2,227,524
May		2,246,531	2,143,674	1,594,724
June		1,585,824	1,800,843	2,386,951
July		1,833,447	1,778,323	1,843,405
August		449,908	474,029	589,406
September		1,984,223	2,125,097	2,296,373
TOTAL		22,854,110	21,916,426	23,004,026
Exchequer Contribution		£401,872	£397,348	£410,151

Cheese- and Butter-Milk Prices. For the purpose of payments under the Milk Acts (whether by the Exchequer to Milk Marketing Boards or by Boards to the Exchequer) in respect of milk used for manufacture, the Minister and the Secretary of State for Scotland, with the approval of the Treasury, have certified the cheese-milk price and the butter-milk price to be 6.40*d.* and 5.55*d.* per gallon respectively for the month of October, 1937.

General Publicity. A further scheme submitted by the Milk Marketing Board on the recommendation of its Advisory Committee on Milk Publicity has been approved. It follows the lines of those conducted during 1935 and 1936 and from November, 1936, to September, 1937. Of the total estimated cost of £60,000 the major portion will be devoted to a press and poster campaign covering the period October, 1937, to September, 1938.

Wheat Act, 1932: Sales of Home-grown Wheat—Cereal Year 1937-38. Certificates lodged with the Wheat Commission by registered growers during the period August 1, 1937, to January 7, 1938, cover sales of 12,287,295½ cwt. of millable

MARKETING NOTES

wheat as compared with 11,734,687 cwt. in the corresponding period (to January 8) last year.

New Anticipated Supply and Quota Payments Order. The Minister, on the recommendation of the Wheat Commission, has made the Wheat (Anticipated Supply) No. 1 Order, 1938, revising the "anticipated supply" of home-grown millable wheat in the cereal year 1937-38 from 26 to 25 million cwt., and the Wheat (Quota Payments) No. 1 Order, 1938, altering the quota payment to which millers and importers are liable on their output of flour from 2.4 pence to 4.8 pence per cwt. as from January 23, 1938. (The new rate is equivalent to 1s. 0d. per sack of 280 lb.).

Sugar Industry (Reorganization) Act, 1936: Production of Home-Grown Beet Sugar during 1937-38 Campaign. According to information furnished by the British Sugar Corporation Ltd., the total quantities of beet sugar manufactured in Great Britain during December, 1937 and the corresponding month in 1936 were

			White cwt.	Raw cwt.	Total cwt.
1937	..	..	639,596	1,585,654	2,225,250
1936	..	..	1,512,186	1,701,007	3,213,193

The total quantities of sugar produced to the end of December in each of the 1937-38 and 1936-37 manufacturing campaigns were

			White cwt.	Raw cwt.	Total cwt.
1937-38	..	..	2,990,417	4,504,304	7,494,721
1936-37	..	..	4,647,203	4,558,873	9,206,076

Livestock Industry Act, 1937: Cattle Fund. The following table gives particulars of payments made out of the fund set up under the Cattle Industry (Emergency Provisions) Acts, 1934 to 1936, and the Livestock Industry Act, 1937:—

Period		Payments	Animals	Average Payment per Animal		
		£		£	s.	d.
April to December, 1935 ..	..	2,809,566	1,188,147	2	7	4
April to December, 1936 ..	..	2,946,415	1,259,414	2	6	9
April to December, 1937*	..	2,878,939	1,189,710	2	8	5
From commencement of subsidy payments to December 31, 1937		12,758,441	5,357,315	2	7	8

* The payments during this period comprised £1,357,828 for 581,700 animals certified under the Emergency Provisions Acts, and £806,848 for 250,833 animals of quality standard and £714,263 for 357,177 animals of ordinary standard certified under the 1937 Act.

MARKETING NOTES

Approval Orders under Section 14. The Livestock Commission, with the approval of the Minister, have made an Order under Section 14 of the Act approving the premises known as the Penrith Farmers' and Kidd's Auction at Penrith for use as a livestock market. The Order was necessitated by the fact that the market has recently been extended to include premises that were not used for the purposes of a livestock market during the year ended November 30, 1936.

An Order under Section 14 has also been made approving premises known as the Farmers' Auction Mart, at Wigan, for use as a livestock market in lieu of a market formerly held on other premises in Wigan under the same management.

Fat Stock: Carcass Sale by Grade and Dead-weight.

During the past year the Grade and Dead-weight Scheme continued to work smoothly at all the Ministry's grading centres, and over 4,300 quotations for separate offers of stock were issued to producers. A total of 12,503 cattle, 29,511 lambs and sheep, and 9,195 pigs were dealt with under the Scheme as compared with 11,834 cattle, 35,709 lambs and sheep, and 9,440 pigs in 1936.

During the greater part of the year under review fat stock prices generally were showing an upward trend. Under these conditions it was anticipated that many producers would be less inclined to avail themselves of the alternative market provided under the Scheme and in consequence there would be some falling off in the number of stock offered. Actually, as will be seen from the figures above, the only class of stock showing any appreciable decline in numbers is sheep and this occurred mainly in the first three quarters of the year. The number of sheep handled during the last quarter, when prices fell generally, showed an increase of 1,929 over the corresponding period of 1936.

The following table shows the grading of the carcasses dealt with during 1937:—

	<i>Super</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>Rejected</i>	<i>Total</i>
CATTLE—						
Bullocks and Heifers..	57	3,568	5,574	1,005	133	10,337
Other Classes ..	—	625	1,022	397	122	2,166
SHEEP—						
Lambs.. ..	—	8,482	8,900	2,895	1,542	21,819
Other Sheep *	—	4,880	1,966	612	234	7,692
PIGS—						
Pork Pigs and Sows ..	—	5,237	3,246	545	167	9,195

MARKETING NOTES

A noteworthy feature of the stock dealt with during the year was the higher proportion of fat cattle which qualified for Grade I. (The percentage of carcasses in this grade increased from 28.3 in 1935 and 1936 to 34.0 in 1937.) This does not necessarily mean that the general level of quality of fat cattle in the country has improved, but it may be attributed in part at least to an increase in the number of producers of best quality fat cattle now using the Scheme.

National Mark Beef. During 1937, 365,617 sides of beef were graded and marked with the National Mark, of which 49.5 per cent. were "Select," 48.8 per cent. "Prime" and 1.7 per cent. "Good."

The total number of sides graded and marked from the commencement of the Scheme in October, 1929, to the end of last year exceeded 2½ millions.

National Mark Publicity. *British Industries Fair.* Arrangements are being made for staging an exhibit of National Mark products at the British Industries Fair, which is to be held at Earls Court from February 21 to March 4. The display will include canned, bottled and fresh fruit and vegetables, fruit juice products, honey, cider and perry, eggs, wheat flakes, cheese, and flour. Samples of various National Mark products, and a range of the Department's publications, will be on sale at the Ministry's stand.

National Mark "Weeks." During the March quarter of 1938, National Mark "Weeks" will be held at Preston (February 2-11), and Southport (March 9-18). The principal features of these campaigns will be National Mark exhibitions, shop-window displays and poster ballot competitions, cinema lectures for housewives and school children, and special cooking demonstrations and competitions for residents of these towns and the surrounding districts.

FEBRUARY ON THE FARM

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At the end of the present month the first days of spring are recorded by the calendar. In the earlier districts the great activity associated with spring work in preparation for the sowing of crops has commenced. In fact, in the earliest districts for potatoes some of the tubers may already be planted. In Jersey, for example, the earliest slopes are commonly planted in January, while the bulk of the planting takes place in February and early March, provided weather conditions are favourable. In all instances the seed potatoes are sprouted in boxes before planting, and early varieties are planted in 18-in. drills. This means a large weight of seed per acre, especially as large sets are frequently used. Liberal applications of artificial manure are applied, often 14-15 cwt. per acre in addition to farmyard manure or sea-weed. These items, along with higher rents and the hand labour needed in many areas, makes the crop an expensive one to grow. In seasons of low prices a good deal of money may be lost in spite of the fact that crops of 10 tons and over per acre are often produced. On the contrary, in years of good prices the returns may be excellent.

The weather during the month is usually characterized by moderate rainfall and sunless conditions. The lengthening period of daylight allows for full working days and is a welcome promise of better weather ahead. While it is important that no opportunity should be lost in furthering spring cultivations, harm may be done by working land prematurely, i.e., before it is sufficiently dry to permit satisfactory cultural treatment. Land put out of condition at this season frequently never recovers for the rest of the year.

Drainage work that still remains unfinished on grass land, and even on arable, should be pushed forward. On grass land appreciable new growth has not yet started, but in mild districts, with suitable weather, growth may be fairly vigorous early in March.

Cereals. A large proportion of the cereal crops grown in this country is spring sown. Advantage will be taken of

FEBRUARY ON THE FARM

any favourable spell during the month to get in wheat on land where autumn sowing was not possible. As compared with autumn-sown wheat, it is usually advisable to allow a more liberal seeding in spring—the plant has not the same opportunity for tillering with the shorter period of growth.

The National Institute of Agricultural Botany recommends Little Joss for February sowing. The leaflet published by that Institute gives much useful information as to varieties of wheat, barley and oats, and is obtainable on application to The Director, National Institute of Agricultural Botany, Huntingdon Road, Cambridge. The choice of the most suitable variety for any set of conditions is a most important matter, on which the County Agricultural Organizer is prepared to give advice.

Maturity is an important matter with malting barley, and on suitable soils much barley may be sown within the next two or three weeks if weather conditions are favourable. It should be borne in mind that barley is more insistent on a good seed bed than wheat. Barley sown under poor conditions seldom gives a satisfactory return, and it is better to wait for good conditions than to risk loss of crop by too hasty sowing.

Grass Land. Grass is the most extensive farm crop in this country and like all other crops is greatly influenced by cultural conditions of soil and manuring. Heavy poaching by stock on strong land during wet weather is particularly harmful during spring, when there is a risk of rapid drying out with resultant bad physical condition. Pastures badly poached in this way often fail to recover during the following summer and produce much less pasturage. Similarly, on permanent hay ground where cattle are being wintered, care should be taken not to allow undue poaching in wet weather. The greatest harm occurs when the grass is short. Rough over-winter grass should be consumed or trodden before spring growth commences. Dung carting and spreading should be completed if possible during this and the following month on permanent hay ground. Careful distribution of the dung is an advantage and makes for a uniform sward. Mechanical treatment of grass land can be carried out with advantage. Where severe harrowing is needed to remove matted turf it is better done early in the season. The lighter

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harrowing for the distribution of the droppings from grazing stock is often left until later.

Some of the grass in certain parts of the country is of a temporary nature, leys of from three to ten years being quite common. Generally speaking, the productiveness of short-term leys, where the management is good, is better than that of permanent grass land. On the stronger soils in the North of England leys of three years or longer have proved most beneficial, because valuable hay or pasture can be obtained from the ley, which after ploughing out, provides plant food and improved physical conditions for succeeding arable crops. The old adage "to break a pasture will make a man, and to make a pasture will break a man," which was perhaps true half a century ago, has very little truth to-day for most parts of the country. This is mainly due to the use of more suitable seed mixtures, improved manuring, and a better understanding of the early management of the new ley. Alternate husbandry has much to recommend it. With short leys, not only is the productiveness greater, but the conditions for grazing stock are healthier. In many districts the arable crops following leys are more abundant and plant diseases are not so troublesome. The chief disadvantages of the temporary ley system are experienced where cattle are outwintered and in areas of low rainfall where droughts are frequent, and there is risk of trouble from insect pests, such as wireworm and leatherjackets, after ploughing the ley. Experience has shown that, provided care is taken to ensure, as far as possible, favourable conditions for the sowing of the seed mixture, satisfactory results can be obtained from temporary leys even in the drier parts of the country. The first essential for success in connexion with temporary leys is to establish a good, vigorous plant that will give a well covered sward from the outset. Seed beds and after-management both play a most important part in the establishment and ultimate nature of the grass land. Success depends as much on these factors as upon the seeds mixture. To establish a ley that will be vigorous and high-yielding from the outset requires good soil conditions from the point of view of physical condition as well as plant food, and also an absence of competition from weed plants.

While there are numerous instances in which very satisfactory pastures have been produced from seeds sown under

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poor conditions, and even on land infested with weeds, the risk is much greater and more time is invariably required before they yield satisfactory results. The best and most uniform "takes" of seeds are usually obtained when the grass and clover seeds are sown with a cereal nurse crop. Barley is most favoured for this purpose, as its growing season is short, and it does not shade the seeds so heavily as other cereal crops; further, the early removal of the barley crop allows the young seeds to make some growth and become well established before the winter.

Grass and clover seeds are usually sown broadcast soon after the corn is drilled, as it is often found that a much more uniform distribution of the plants is obtained by broadcasting than by the use of the coulter drill. It is most important that a good tilth should be secured. Both grass and clover seeds are small, and satisfactory plant establishment is only likely to be obtained with a fine, firm seed bed.

Sheep. February is an important month as far as sheep stocks are concerned, on both lowland and hill farms. In many instances arable flocks will finish lambing, and the need of suitable food for the nursing ewes is one of the chief problems. It is not easy to keep a good supply of milk during bad weather without fresh succulent foods like grass, vetches and other such young growing plants.

On lowland grass and hill farms, lambing usually commences later, and the important point during the present month is to make sure that the pregnant ewes are not losing condition. While both hill and lowland flocks usually make satisfactory progress if sufficient pasturage is available during the first period of pregnancy, some help may be needed if the ewes are not to lose weight and condition during the later stages. The strain of the winter period and the falling off in quantity and quality of food account for this. Ewes that show distinct signs of falling off in condition should be separated and given special treatment. On lowland grass farms it is customary to adopt some form of hand feeding of the in-lamb ewes during the later stages of pregnancy, but with hill ewes this frequently is not done. Experiments carried out by Mr. Lyle Stewart, M.R.C.V.S., in Northumberland, show that hill ewes lose a good deal of body weight from the end of January until the grass comes. While it is recognized that there are many difficulties in giving supplementary food to hill flocks,

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and probably many objections, the possibility of the economic use of some suitable supplementary food might be explored with advantage. Experimental sheep receiving an allowance of food in addition to pasture have not shown the same loss in body weight. The economic aspect of the matter, however, has not received enough consideration.

Pregnancy toxaemia causes considerable loss amongst breeding flocks. In this connexion it should be borne in mind that with sheep, as with all breeding animals, it is advisable to feed to a carefully balanced diet. The diet should not only be carefully balanced with regard to protein and starch equivalent, but it should be such as to keep the digestive system in good working condition. A slightly laxative condition is to be preferred to any tendency to constipation. Exercise is important as it keeps all organs in good tone.

It is customary to reserve fields for lambing, and the stock are normally put on to fields that have been rested and contain more fresh food, just before lambing and at a time when trouble from pregnancy toxaemia is most likely to occur.

NOTES ON MANURING

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Balanced Manuring. Data for annual fertilizer consumption over a period of years show marked changes in the ratio of the amounts of the different plant nutrients consumed in different years. The extent of these changes was indicated in these notes for May, 1937, when reference was also made to possible causes of these fluctuations. The changes are obviously not related to changes in the needs of the crops themselves, and no doubt publicity, among other things, plays a considerable part in the 'popularity or otherwise of any one type of fertilizer.

The present time, therefore, seems opportune for further reference to this subject, and particularly for emphasizing that, though nitrogenous and potassic fertilizers may not be necessary on some types of grass land, a manuring programme for arable land must include, somewhere in the rotation, adequate supplies of these fertilizers as well as phosphates and lime. The Land Fertility Scheme has given wide publicity to the use of fertilizers in general, but particular emphasis has been placed on the use of lime and phosphate, for the purpose of which special financial assistance has been granted. The reasons for this have already been discussed in this JOURNAL and elsewhere, particularly the desire to improve the large areas of poor grass land, for which purpose, in many districts, phosphate (with or without lime) is the only fertilizer required. It is important to remember, however, that even the most fervent advocates of the Land Fertility Scheme would not suggest that all the money a farmer may be prepared to spend on fertilizers should be invested in phosphatic fertilizers. This would be very undesirable even on some types of permanent grass, and would be entirely wrong on arable land.

Crops cannot live on phosphate alone, and, on many farms, as crops such as potatoes, mangolds and sugar-beet receive the bulk of the artificial fertilizer, some reference to the importance of potassic fertilizers for these crops may serve as a

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timely reminder to farmers who have not yet decided on the manuring for their 1938 potato and root crops.

Effect of Potash on Potatoes. On land farmed and fertilized on normal lines, potash should always be included in a fertilizer mixture for the potato crop. It is important not only for its well-known effects on the total yield of the crop and on the quality of the tubers, but also for its beneficial effect on the proportion of tubers of ware size. As tuber size has assumed greater importance since the advent of the Potato Marketing Board, with its power to prescribe the size of riddle to be used in the separation of ware from seed and chats, more detailed information on this point may be of interest. Data illustrating the effects of nitrogen, phosphate and potash on the proportion of ware-size tubers in several experiments were given in these notes for March, 1937. Examination of data from a larger number of experiments has now been made by H. V. Garner at Rothamsted, and the results have been published in the October, 1937, issue of *The Empire Journal of Experimental Agriculture*. Although the riddles used to separate the ware tubers varied from $1\frac{1}{2}$ to $1\frac{3}{4}$ in. at different centres, the results nevertheless serve to indicate the effect of fertilizer on the proportion of large to small tubers. In general, these results support the main suggestions made in the March, 1937, notes. Potash will often bring about a substantial increase in the proportion of tubers of ware size, especially in circumstances in which potash increases the total yield of the crop. Phosphate and nitrogen on the other hand, despite their markedly beneficial effect on the actual yield of tubers, exert a much smaller effect on the proportion of ware than does potash. Dung has definitely beneficial effect on the proportion of ware-size tubers, but the effects of potash and dung are not entirely independent, the beneficial effect of potash being less marked, though still important, where dung is used than where the crop receives no dung. The average effect of the three chief plant nutrients over the whole of the experiments included in Garner's survey were as follows :—

Nitrogen	increased	the	percentage	ware	by	2.0
Phosphate	"	"	"	"	"	2.1
Potash	"	"	"	"	"	7.6

In general, dung was even more effective than potash in this respect, a result that illustrates once again the value of dung

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to the potato crop. The interaction between potash and dung emphasizes the special importance of ensuring an adequate supply of potash where only a light dressing of dung is available.

Although potash is generally believed to be most effective on light sandy soils, the Rothamsted experiments have shown beneficial effects on the potato crop on quite heavy soils. The quantity best suited for any particular farm or field may vary from 1 to 4 cwt. of sulphate of potash per acre according to circumstances such as soil, past treatment, and the amount of dung and other fertilizer to be used, but there are relatively few occasions on which some potash cannot be profitably included in a potato fertilizer.

The Effect of Potash on the Sugar-Beet Crop. The inclusion of potash in a fertilizer mixture for sugar-beet has been almost universally advocated for many years. Reliable experimental evidence in support of this recommendation, however, was not very readily obtained in this country, although the extensive series of trials carried out annually since 1933 by the Rothamsted staff in co-operation with the Sugar-beet Factory staffs and with the support of the Sugar-Beet Education and Research Committee, are now providing information on this point.* Averaging the results from all centres in this series of trials in which no dung was used, muriate of potash applied at the rate of $1\frac{1}{2}$ cwt. per acre gave a small but profitable increase in the average yield of sugar per acre during the four years 1933 to 1936 inclusive—the average increase being of the order of 1 cwt. of sugar per acre.

A double dressing of muriate of potash ($2\frac{1}{2}$ cwt. per acre) was not appreciably better than the single dressing in 1934 and 1935, but gave a substantial increase over the single dressing in 1936, a much wetter season than the two preceding years. The figure obtained by averaging the results from a large number of centres on widely different soil types is not always the best criterion, however, since the treatment under consideration may be beneficial on one soil type and useless or even detrimental on some other soil type. This seems to have been true to some extent in this series of experiments, for a grouping of the results for 1936 according to soil type shows that potash was markedly effective on the lighter soils but actually reduced the yield of sugar on some of the heavy soils.

* See Rothamsted Report for 1936.

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Soil Type	Increase in Yield of Sugar (cwt. per acre) in 1936 due to :—					
	Muriate of Potash			Muriate of Potash		
	@ 1½ cwt. per acre			@ 2½ cwt. per acre		
Coarse sand	+ 1·8	..	+ 3·3
Fine sand	+ 2·6	..	+ 4·4
Light loam	+ 0·3	..	+ 1·5
Heavy loam	+ 0·2	..	— 1·2
Clay loam	+ 0·0	..	— 1·4
Fen	+ 2·1	..	+ 4·2

The cash value of the larger increases in the above table is, of course, considerably greater than the cost of the potash fertilizer, the cost of the single dressing being equivalent to the value of about 0.8 cwt. of sugar at 1938 prices.

The effect of potash on yield of washed beet was very similar to its effect on yield of sugar. In 1936, increases up to two tons per acre were obtained on light soils, but on heavy soils its use was frequently associated with a reduction in the yield of roots. Potash gave a small increase in the average sugar percentage of the roots in all four years 1933-1936, the annual average increase varying from 0.14 to 0.24—a result that corroborates the general opinion that potash helps to keep up the sugar percentage. It is interesting to note that this increase in sugar percentage was not confined to the lighter types of soil. In 1936, potash increased the sugar percentage at six of the seven heavy and clay loam centres, though not always sufficiently to compensate for the accompanying reduction in the yield of washed roots. The average increase in sugar percentage at these heavy-land centres was of the same order as that at the six centres on coarse sandy soil.

These experiments also confirm the importance of maintaining a proper balance between the amounts of potash and nitrogen in a fertilizer mixture for sugar-beet. The nitrogenous fertilizer used was sulphate of ammonia, and in the three years 1934 to 1936 the full benefit from the nitrogen was only obtained when a suitable amount of potash was included in the fertilizer. Similarly, the full benefit from potash was only obtained when nitrogen was also included in the mixture, the response in yield of sugar to either fertilizer being about 2 cwt. per acre greater when the other was present than when it was absent. This interaction between nitrogen and potash is, of course, not confined to the sugar-beet crop, but is a generally recognized phenomenon with many agricul-

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tural crops, as well as with glasshouse crops such as tomatoes and with fruit such as dessert apples.

The optimum amount of potash to include in a fertilizer mixture for sugar-beet will depend on such circumstances as those mentioned above in the consideration of the potato crop. In general, a suitable quantity for use in conjunction with about 3 cwt. per acre of nitrogenous fertilizer and 2 to 4 cwt. per acre of superphosphate, will be within the range $\frac{1}{2}$ to $1\frac{1}{2}$ cwt. per acre of muriate of potash or 1 to 3 cwt. per acre of 30 per cent. potash salts, the largest dressings being required on very light soils and where potash is not applied to other crops in the rotation.

Potash is, of course, just as important for the mangold crop as for the sugar-beet crop. Here again its effectiveness is closely associated with the presence of an adequate amount of nitrogenous fertilizer. The response to potash, however, is less where nitrate of soda is used than where the nitrogen is supplied in the form of sulphate of ammonia, since mangolds are apparently able to use sodium for many of the functions normally fulfilled by potassium.

Top-dressing Spring Cabbage. As this crop often follows one that received dung and artificial fertilizer, e.g., early potatoes, it does not usually receive much fertilizer in the autumn, though phosphates will help to establish sturdy young plants, especially where spring greens are drilled *in situ*, and potash is often used to encourage winter hardiness. Whatever the autumn treatment, however, the crop will usually respond well to spring applications of quick-acting nitrogenous fertilizer. There is no point in applying the fertilizer before soil and climatic conditions are such that the crop can utilize the nitrogen, and though early February may not be too soon to apply top-dressings for the earliest cuttings in the southern part of the country, early March is usually soon enough in the north. There is very little direct experimental evidence as to the relative merits of different types of nitrogenous fertilizer for this purpose, nor as to the optimum amounts to apply, but nitrate nitrogen is likely to be most quickly available to the crop and therefore the best form of nitrogen where the object is to push on the crop as rapidly as possible. Spring greens, where earliness is specially important and "hearting" is not, will probably pay for heavier dressings of nitrogenous fertilizer than crops that are

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to be cut as "hearted" cabbage. Just as mild "growing" weather in autumn and early winter may lead to "hearting" long before the crop was intended to be cut, so spring weather and market conditions largely determine whether or not top-dressings will be profitable and how long the crop shall be left before cutting. Spring greens will usually benefit from an initial top-dressing of $1\frac{1}{2}$ to 2 cwt. per acre of nitrate of soda, nitrate of lime or potash nitrate, given as early as weather conditions permit, followed by further similar dressings at about fortnightly intervals until the crop is cut.

For hearted cabbage two top-dressings should suffice.

The leaves of spring cabbage are very susceptible to scorching and spotting by fertilizer. Hence, top-dressings should not be broadcast in such a way that fertilizer falls directly on to the leaves, but they should be applied, as far as possible, to the soil alongside each row of plants.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended Jan. 5				
	Bristol	Hull	L'pool	London	Costs per Unit [¶]
Nitrate of Soda (N. 15½%) ..	£ 8 0c	£ 8 0c	£ 8 0c	£ 8 0c	s. 10 4
" " Granulated (N. 16%) ..	8 0c	8 0c	8 0c	8 0c	10 0
Nitrate of Lime (N. 13%) ..	7 7e	7 7e	7 7e	7 7e	11 4
Nitro-Chalk (N. 15½%) ..	7 10c	7 10c	7 10c	7 10c	9 9
Sulphate of Ammonia —					
Neutral (N. 20·6%) ..	7 11c	7 11c	7 11c	7 11c	7 4
Calcium Cyanamide (N. 20·6%) ..	7 12d	7 12d	7 12d	7 12d	7 5
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 4	5 1	5 0	5 1	3 5
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%) ..	8 10	8 8	8 5	8 8	3 4
Sulphate " (Pot. 48%) ..	10 2	10 0	9 17	10 0	4 2
Basic Slag (P.A. 15½%) ..	2 12b	2 5b	—	2 10b	3 2
" " (P.A. 14%) ..	2 8b	2 0b	2 0b	2 6b	3 3
Grd. Rock Phosphate (P.A. 20-27½%) ..	3 7a	3 2a	2 18a	2 12a	2 0
Superphosphate (S.P.A. 16%) ..	3 4	—	3 5f	3 0g	3 9
" " (S.P.A. 13½%) ..	3 1	2 17	3 2f	2 16g	4 1
Bone Meal (N. 31½%, P.A. 20½%) ..	—	7 5	7 5h	7 2	—
Steamed Bone Flour (N. 1%, P.A. 27½-29½%) ..	5 5i	5 10	4 17h	4 15	—

Abbreviations: N = Nitrogen;
S.P.A. = Soluble Phosphoric Acid,

P.A. = Phosphoric Acid;
Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 5-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 5 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra and for lots of 4 cwt. and under 1 ton, 20s. extra.

e For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, for lots of 1 ton and under 2 tons 7s. 6d. per ton extra, and for lots of under 1 ton, 20s. extra.

f Prices shown are f.o.r. Widnes.

g Prices shown are f.o.r. northern rails; southern rails, 1s. 3d. extra.

h Prices shown are f.o.r. Appley Bridge.

i Price shown is f.o.r. Newport, Mon.

¶ These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent nitrogen, contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Pasteurized Milk in Calf Rearing. In the Notes for July, 1937, an account was given of a series of comparisons of raw milk with pasteurized milk carried out with calves on the Auchincruive farm of the West of Scotland Agricultural College. In these tests there was an apparent small advantage in favour of the raw milk, but the opinion was expressed in the Notes that owing to the smallness of the groups used the results could "hardly be accepted as decisive."

Justification for this note of caution is to be found in the results of two further investigations, the reports of which were published during the past year.

The first of these (Wilson, Minett & Carling, *Journal of Hygiene*, Vol. XXXVII, p. 243) deals with an experiment carried out under joint veterinary and agricultural control on a sanatorium farm between July, 1934, and September, 1936. The general plan of the experiment was to feed alternate calves, as they were born, on raw or pasteurized milk for eight weeks, and to compare their rate of growth. The Shorthorn herd used has been tubercle-free since 1932, and has also an excellent record with regard to freedom from contagious abortion, Johne's disease and mastitis. The pasteurization of the milk was carried out on the farm to ensure efficiency. The milk used was always taken from the mixed morning milk of the herd, one-half being pasteurized and the other left untreated. Both portions were warmed to about 90°F. at the time of feeding, the milk required for the evening feed being kept cool throughout the day. It is of interest to note that where the last-named precaution was inadvertently omitted a certain amount of "scouring" developed in the calves.

One practical defect of the "random" assignment of the calves to the two treatments was that it resulted in a very uneven distribution of the sexes, there being far fewer bull calves allocated to the pasteurized than to the raw milk group. The chances were thus weighted to some extent in favour of the raw milk. Only two calves—both assigned to the pasteurized milk group—died in the course of the experiment,

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but in neither instance could death be in any way attributed to the type of diet that was being given.

The quantity of milk fed was rationed in proportion to the live-weight of the calf, starting with 1 lb. milk daily per 10 lb. liveweight for the first few weeks and a rather higher proportion later—though not enough, as experience proved, to cover the needs of maximum growth. Every calf received its mother's colostrum for 3½ days before being put on the milk diet.

Besides milk, the calves were provided with hay *ad lib*, but as a rule did not eat any appreciable amount of it in the first month, after which each animal consumed about 1 lb. daily, rising to 3 lb. by the eighth week.

In all, twenty-five calves (13 bulls, 12 heifers) were reared on the raw milk, and twenty-three (8 bulls, 15 heifers) on the pasteurized milk. All thrived well and showed no obvious signs of rickets or anaemia.

As was to be expected from the higher proportion of bull calves in the raw milk group, the average initial liveweight in this group was rather higher (2.23 lb.) than in the pasteurized milk group. A closely similar difference (2.09 lb.) in the same direction was found in the average weights at 8 weeks old, so that the average live-weight gains (53.72 lb., 53.86 lb.) were practically identical. From time to time the calves were inspected by outside observers, such as the county milk recorder and local farmers, but at no time throughout the experiment was any observer, lay or professional, able to distinguish between the two groups of animals. In short, no evidence could be obtained, either from growth rates or skilled observation, to suggest that the nutritive value of pasteurized milk for calves is in any way inferior to that of raw milk.

The other investigation (Wilkie, Edwards, Fowler & Wright, *Journal of Dairy Research*, Vol. XIII, p. 311), which led to the same general conclusion, comprised two trials which were carried out in 1935 and 1936 respectively, at the Hannah Dairy Research Institute, using milk produced and processed under typical commercial conditions. The milk used was drawn from the bulked milk of ten farms. Bull calves alone were used for the experiment, these being taken from tuberculin-tested Ayrshire herds at 2-3 days old, when they had received two to five feeds of colostrum. On arrival of the calves at the Institute they were allotted to two groups in random fashion.

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Housing was arranged in two isolated units, which were over a quarter of a mile apart, and were furnished at their entrances with foot-baths of strong disinfectant. Each unit had its own attendant. Between feeding times the calves, though tethered, had ample opportunity of exercise in the huts.

Starting with one pint each per day the allowance of milk was gradually increased until it represented a daily amount equal to one-tenth of the body weight of the calf at the last weekly weighing. An average allowance of $\frac{2}{3}$ lb. of hay per head daily was also offered from the eighth to the twelfth week of life. In addition to the weekly weighings various measurements of each calf were made in the first and twelfth weeks. At the end of the experiment they were paraded before a panel of judges, put through the double intra-dermal test and finally slaughtered, post-mortem examinations being made of the carcasses.

A preliminary trial with calves born in the spring of 1935 had already shown a death-rate of 62 per cent.—18 deaths having occurred in the pasteurized milk group, and 21 in the raw milk group. Of these deaths 40 per cent. were attributable to *Bac. coli* septicaemia, and 37 per cent. to lung infections. Accordingly the two trials now reported were carried out with calves born in the autumn, for which a lower mortality rate has been claimed than for spring calves.

Taking the two trials together a total of 92 calves were used. Nineteen calves died before completion of the experiment, 5 of these being in the pasteurized milk group, and 14 in the raw milk group. The mean ages of these calves at death were 44 and 27 days respectively.

Of the 73 calves that completed the full 12 weeks of the experimental feeding, 37 received pasteurized milk, and 36 raw milk. The former group showed a mean percentage gain in live weight of 80.2 ± 3.1 , and the latter 74.5 ± 2.7 , the difference of 5.7 ± 4.1 being non-significant. In both groups the average growth-rate was low, this doubtless being largely due to the fact that no food other than milk was given during the first eight weeks, in order that any minor differences in the nutritive value of the two classes of milk might not be masked.

Marks awarded by experienced stock judges showed consistent differences in favour of the pasteurized milk group, but the "significance" of such differences cannot be assessed.

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No appreciable differences were noted in the skeletal growth of the two groups.

Daily samples of the milk were combined for the purpose of tests twice weekly with guinea-pigs. With the raw milk these revealed the presence of viable tubercle bacilli in 70 per cent., and *Br. abortus* in 38 per cent. of the samples. The pasteurized milk samples were uniformly negative to both tests.

These differences in tuberculous infection of the two types of milk were reflected in the results of tuberculin tests and post-mortem examinations on the calves at the end of the experiments. Out of the 36 calves on the raw milk diet 24 reacted to the test, and the presence of tuberculous lesions was confirmed in 23 cases by post-mortem examination. One calf in the pasteurized milk group reacted to the test, but exhaustive post-mortem examination and inoculation of glandular material into guinea-pigs failed to confirm the presence of any tuberculosis.

Reviewing the information furnished by these two comprehensive investigations, the practical equivalence of pasteurized milk with raw milk for calf-rearing, so far as this can be measured by growth-rates, would seem to be clearly demonstrated. If this be accepted, then the greater measure of safety against infection afforded by the pasteurized milk becomes decisive in its favour.

Influence of Grit on Digestibility of Grain by Fowls. Although the subject of occasional experiment for more than 150 years the grit question still remains a topic of controversy among poultry-keepers. The invariable presence of grit in the gizzards of birds living under natural conditions, and the tough, horny nature of the gizzard lining seem almost to postulate that some useful purpose is being served by the combination, and the most obvious purpose would seem to be that of providing a substitute for the lack of teeth for grinding up the hard grains. In a brief review of the subject, prepared for the 6th World's Poultry Congress, Halnan arrived at the conclusion that "although grit is not essential, its use is desirable on account of its increasing the efficiency of utilization of food materials and maintaining the normality of the digestive tract." A further contribution to the subject appears in the issue of the *Archiv fuer Gefluegelkunde* referred to last month, in the form of a report on experiments carried out in the

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Animal Nutrition Research Institute, University of Berlin. These experiments consisted of determinations of the digestibility of barley grain, with and without the addition of grit. The experimental animals were four White Leghorn pullets, six months old, which had been reared in the Institute on diets entirely free from grit. Flint grit was used, but with the object of reducing the risk of mechanical damage to the soft-walled gizzards of the birds a little limestone grit was given before passing on to the full allowance of flint grit. That some damage was actually caused to the gizzard by the grit was shown by the fact that the digestibility of the barley was lower in the second half than in the first half of the period. If the results with grit for the first half be taken as the more normal they were practically identical with those obtained without grit, the organic matter of the barley being digested to the extent of 74.4 per cent. in the former instance, and 74.7 per cent. in the latter. Rather curiously, the fibre of the barley was rather better digested without than with the grit. From these and previous experiments carried out at the Berlin Institute the general conclusion is drawn that whatever beneficial action the grit may have, it is not reflected in any enhanced digestion of the food.

Digestion of Food by the Rabbit. In recent years an increasing interest has developed in the commercial possibilities of rabbit-keeping for meat production. As with other forms of meat production the economics of the process turn largely upon food costs, and more particularly upon the efficiency with which the food is converted into meat. Advisory work in this connexion has hitherto been badly hampered by the lack of data as to the extent to which the different classes of food commonly used are digested by the rabbit. In default of such information the digestibility data obtained for these foods in trials with sheep and pigs have been used, but this is obviously unsatisfactory and may be misleading.

The older agricultural literature contains accounts of a few comparisons of rabbits with sheep which indicated that for the foods tested the digestibilities were of the same order with the two classes of animal. More recently (1934) similar comparisons with artificially dried pasture herbage of five-weeks growth have been made by Watson & Godden at the Rowett Institute. These showed the digestive powers of the rabbit for this class of food to be much inferior to those of

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the sheep, the average digestion coefficients of the total organic matter being 48.6 and 77.2 per cent. respectively. This general inferiority for digesting young grass was shown with respect to each group of nutrients, the most striking difference being in regard to the crude fibre, which was only digested to the average extent of 26.0 per cent. by the rabbit as compared with 74.5 per cent. by the sheep. A similarly low power of fibre digestion by the rabbit was also found by Watson & Horton in tests made in 1933 at Jealott's Hill. With three samples of grass, sheep digested 72-78 per cent. of the organic matter, whilst rabbits digested only 63 per cent. Of the crude fibre the sheep digested 78-84 per cent., the rabbits only 47-51 per cent. With a sample of marrow stem kale the corresponding data for organic matter were 85 and 83 per cent., and for fibre 74 and 55 per cent. respectively. Only with protein did the digestive powers of the rabbit prove to be about equal to those of the sheep.

More comprehensive information on the digestion of a variety of foods by the rabbit is now available from recent German experiments (Brueggemann) published in the current number of *Die Tierernaehrung* (Vol. 9, p. 374). The average results are summarized in the following table, in which the *total* fibre in the dry matter of each food used is also included. The digestion coefficients have been rounded off to whole

	Total Fibre	Digestion Coefficients					
		Organic Matter	Crude Protein	True Protein	Crude Oil	Crude Fibre	" Carbo- hydrates "
	%	%	%	%	%	%	%
Meadow Hay ..	32.9	47	60	63	43	18	64
Lucerne ..	27.6	61	76	74	16	39	73
Nettle ..	17.9	63	96	90	32	42	79
Green Lucerne ..	23.6	81	89	87	71	66	88
Green Sweet Lupins ..	23.0	79	91	90	73	56	84
Maize Silage ..	31.4	55	79	37	96	24	69
Oats ..	17.9	64	79	79	90	18	72
Barley ..	10.9	90	78	80	90	72	93
Wheat ..	8.1	94	81	80	92	90	97
Mangolds ..	6.0	97	66	36	—	100	96
Steamed Potatoes	5.9	98	58	54	100	100	99
Dried Grass* ..	21.4	49	61	—	26	26	56
" " † ..	22.0	63	77	75	16	49	66
Marrow Stem Kale† ..	11.5	83	86	84	72	55	88

* Watson & Godden.

† Watson & Horton.

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numbers. The British data referred to above have also been appended.

The close correlation between the fibre-content of the food and the rabbit's power of digesting it is brought out clearly by the data in the first two columns of the table. Thus, whereas the rabbit digests only from one-half to two-thirds of the organic matter of the highly fibrous hays, it digests 90 per cent. or more of the organic matter of the low-fibrous grains. On these results oats compare unfavourably with barley and wheat as a source of digestible food for the rabbit, 100 parts of oats supplying only 57 parts of total digestible nutrients, as compared with 77 parts from the same weight of barley, and 82 parts from wheat. It will also be noted that, in the main, as the proportion of fibre in the food decreases the digestibility of the fibre itself tends to increase.

That the rabbit is much inferior to the sheep in digesting the more fibrous types of food was also confirmed in these experiments by a direct comparison made with the meadow hay used. The average results of such comparisons in the British and German tests are summarized below:—

	Digestion Coefficients					
	Dried Grass				Hay	
	Watson & Godden		Watson & Horton		Brueggemann	
	Rabbit	Sheep	Rabbit	Sheep	Rabbit	Sheep
	%	%	%	%	%	%
Organic Matter	49	77	63	78	47	67
Crude Protein	61	77	77	78	60	60
True Protein	—	—	75	75	63	59
Crude Oil	26	52	46	52	43	32
Crude Fibre	26	74	49	80	18	72
Carbohydrates	50	81	66	78	64	76

The Water Needs of the Rabbit. The same German report furnishes information also on the consumption of water by the five animals used for the digestion trials. This is the more interesting as the question whether the rabbit needs a separate supply of drinking water is a matter of perennial controversy amongst rabbit-keepers. In this trial the answer was very definitely in the affirmative, as may be seen from the following summary of the average daily water-intake per head on the various diets used in the digestion trials.

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<i>Diet</i>	<i>Water contained in Food c.c.*</i>	<i>Additional Water Drunk c.c.</i>	<i>Total Water Intake c.c.</i>
Meadow Hay	11	156	167
Lucerne	17	144	161
Nettle Hay + Steamed Potatoes	156	—	156
Green Lucerne	235	—	235
Green Sweet Lupins	394	—	394
Maize Silage + Meadow Hay	96	12	108
Oats	12	101	113
Barley + Meadow Hay ..	19	142	161
Wheat +	19	121	140
Mangolds +	202	—	202
Steamed Potatoes + Meadow Hay	160	—	160

* 1 pint = 567 c.c.

It will be noted that with the drier foods the rabbits took a considerable amount of water from the drinking trough. In these instances the average amount of water taken ranged from 101 to 156 c.c., and the total water intake (including moisture in the food) ranged from 113 to 167 c.c. (=0.2 - 0.3 pint). With the succulent foods (lucerne, lupins, mangolds) the rabbit clearly received in the food itself more water than was actually necessary. Further, the water consumption on each diet varied considerably as between different individuals, as is shown by the following summary of individual water consumption on the hay diet.

	<i>Rabbit : No. 1 c.c.</i>	<i>No. 2 c.c.</i>	<i>No. 3 c.c.</i>	<i>No. 4 c.c.</i>	<i>No. 5 c.c.</i>
Av. Daily Water consumption	126	148	118	188	200
Range of Variation ..	100-173	123-197	102-178	125-228	148-248

These observations are in close agreement with those made in 1933 by Christian at Reading, in which it was found that rabbits on dry mash and water took from 80 to 100 c.c. of water per head daily in ordinary conditions and rather more in warm weather.

The broad general conclusion may be drawn, therefore, that when the rabbit is entirely on "dry" food it requires a water supplement amounting on the average to about one-quarter of a pint daily.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb. ..	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv
Wheat, British ..	£ s. 8 12	£ s. 0 9	£ s. 8 3	72	s. d. 2 3	d. 1·21	% 9·6
Barley, British Feeding ..	9 0	0 9	8 11	71	2 5	1·29	6·2
" Canadian No. 3 ..	8 12	0 9	8 3	71	2 4	1·25	6·2
Western ..	8 12	0 9	8 3	71	2 4	1·25	6·2
" Argentine ..	8 12	0 9	8 3	71	2 2	1·16	6·2
" Persian ..	8 3	0 9	7 14	71	2 3	1·21	6·2
" Russian ..	8 7*	0 9	7 18	71	2 10	1·52	7·6
Oats, English, white ..	9 0	0 10	8 10	60	2 9	1·47	7·6
" " black and grey ..	8 13	0 10	8 3	60	3 0	1·61	7·6
" Scotch, white ..	9 10	0 10	9 0	60	3 4	1·79	7·6
" Canadian— No. 2 Western ..	10 10*	0 10	10 0	60	2 11	1·56	7·6
No. 3 Western ..	9 5†	0 10	8 15	60	2 7	1·38	7·6
Mixed feed ..	8 7	0 10	7 17	60	1 9	0·94	7·6
Maize, American ..	7 3†	0 7	6 16	78	1 10	0·98	7·6
" Argentine ..	7 13	0 7	7 6	78	1 9	0·94	7·6
" South African— No. 2 White..	7 3†	0 7	6 16	78	1 10	0·98	7·6
No. 4 Yellow ..	7 7†	0 7	7 0	78	2 1	1·12	19·7
Beans, English, Winter ..	7 15	0 18	6 17	66	6 2	3·30	18·1
Peas, Japanese ..	22 2†	0 15	21 7	69	3 0	1·61	18·1
" English, blue ..	11 0	0 15	10 5	69	3 4	1·79	9·9
Milling Offals:— Bran, British ..	8 2	0 17	7 5	43	3 7	1·92	10·0
" Broad ..	8 10	0 17	7 13	43	2 3	1·21	12·1
Middlings, fine, imported ..	8 7	0 14	7 13	69	2 9	1·47	10·7
Weatings† ..	8 7	0 15	7 12	56	2 4	1·25	12·1
" Superfine† ..	8 15	0 14	8 1	69	2 11	1·56	11·0
Pollards, imported ..	8 0	0 15	7 5	50	2 7	1·38	6·2
Meal, barley ..	9 12	0 9	9 3	71	2 4	1·25	6·2
" " grade II ..	8 17	0 9	8 8	71	1 11	1·03	7·6
" maize ..	7 17	0 7	7 10	78	1 10	0·98	7·6
" " South African ..	7 10	0 7	7 3	78	1 9	0·94	10·3
" " germ ..	7 15	0 11	7 4	84	2 1	1·12	3·6
" locust bean ..	7 15	0 6	7 9	71	2 7	1·38	19·7
" bean ..	9 7	0 18	8 9	66	4 4	2·32	53·0
" fish (white) ..	15 0	2 5	12 15	59	2 6	1·34	38·3
" Soya bean (extracted)† ..	9 10	1 11	7 19	64	1 11	1·03	9·2
Maize, cooked, flaked ..	8 7	0 7	8 0	84	2 7	1·38	24·6
Linseed cake— English, 12% oil ..	10 12	1 1	9 11	74	2 5	1·29	24·6
" 9% " ..	10 0	1 1	8 19	74	2 4	1·25	24·6
" 8% " ..	9 15	1 1	8 14	74	2 2	1·16	17·3
Cottonseed cake— English, Egyptian seed, 4½% oil ..	5 10	0 19	4 11	42			

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Cottonseed cake—							
Egyptian, 4½% oil ..	5 2	0 19	4 3	42	2 0	1·07	17·3
Cottonseed cake, decorticated, 7% oil	8 0†	1 10	6 10	68	1 11	1·03	34·7
Cottonseed meal, decorticated, 7% oil	8 5†	1 10	6 15	70	1 11	1·03	36·8
Coconut cake, 6% oil	7 12†	0 19	6 13	77	1 9	0·94	16·4
Ground nut cake, 6-7% oil	7 0*	0 19	6 1	57	2 1	1·12	27·3
Ground nut cake, decorticated 6-7% oil	8 12*	1 9	7 3	73	2 0	1·07	41·3
Ground nut cake, imported decorticated, 6-7% oil	7 15	1 9	6 6	73	1 9	0·94	41·3
Palm-kernel meal, 1-2% oil	6 15	0 13	6 2	71	1 9	0·94	16·5
Feeding treacle	5 0	0 8	4 12	51	1 10	0·98	2·7
Brewers, grains, dried alc	6 7	0 11	5 16	48	2 5	1·29	12·5
Brewers' grains, dried porter	6 0	0 11	5 9	48	2 3	1·21	12·5
Dried sugar-beet pulp	From £5 5s. 0d. to £5 15s. 0d. per ton ex-factory (according to factory)						

* At Bristol.

§ At Hull.

† At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE : The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex-mill or store. The prices were current at the end of December, 1937, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 1s. per ton as shown above, the cost of food value per ton is £9 19s. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1·43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 7s. 6d.; P₂O₅, 2s. 7d.; K₂O, 3s. 8d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6·2	8 8
Maize	78	7·6	7 13
Decorticated ground nut cake	73	41·3	8 3
„ cottonseed cake	68	34·7	8 0
(Add 10s. per ton, in each instance, for carriage.)			

The cost per unit starch equivalent works out at 2·26 shillings, and per unit protein equivalent 0·32 shilling. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent Per cent.	Protein equivalent Per cent.	Food Value per ton, on farm £ s.
Wheat	72	9·6	8 6
Oats	60	7·6	6 18
Barley	71	6·2	8 2
Potatoes	18	0·8	2 1
Swedes	7	0·7	0 16
Mangold	7	0·4	0 16
Beans	66	19·7	7 15
Good meadow hay	37	4·6	4 5
Good oat straw	20	0·9	2 5
Good clover hay	38	7·0	4 8
Vetch and oat silage	13	1·6	1 10
Barley straw	23	0·7	2 12
Wheat straw	13	0·1	1 9
Bean straw	23	1·7	2 13

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, price 6d., post free 7d.

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1937*

Produce of Crops

The areas under wheat, barley, seeds and meadow hay, as returned in June, 1937, were greater than those returned for the same crops in June, 1936, but the acreages of other crops were smaller than in the previous year.

The estimated total production of wheat, hay and potatoes was larger than in 1936, but lower figures were recorded for barley, oats, beans, peas, mangolds, turnips and swedes. The reduction of oats, beans and peas, which showed higher yields per acre than in 1936, was attributable to the smaller acreages returned. The estimated yield per acre and production of wheat showed very little change from 1936.

Only the yields per acre of mixed corn, hay, beans and potatoes were higher than the averages for the past ten years, the decrease for barley being particularly noticeable.

PRELIMINARY STATEMENT SHOWING THE ESTIMATED TOTAL PRODUCE AND YIELD PER ACRE OF THE CORN, HAY AND ROOT CROPS IN ENGLAND AND WALES IN 1937, WITH COMPARISONS FOR 1936, AND THE AVERAGE YIELD PER ACRE OF THE TEN YEARS 1927-1936

CROPS	Estimated Total Produce		Acreage		Estimated Yield per Acre		
	1937	1936	1937	1936	1937	1936	Average of the Ten years 1927-1936
	Thou- sands of Tons	Thou- sands Of Tons	Acres	Acres	Cwt	Cwt	Cwt
WHEAT	1,393	1,378	1,731,833	1,704,469	16·1	16·2	17·7
BARLEY	576	663	822,828	818,924	14·0	16·2	10·3
OATS	938	1,080	1,223,098	1,419,695	15·3	15·2	15·8
MIXED CORN ..	75	75	91,808	96,994	10·2	15·4	15·6
SEEDS HAY* ..	2,141	1,674	1,466,783	1,338,849	29·2	25·0	20·4
MEADOW HAY†	4,967	4,733	4,674,995	4,668,812	21·2	20·3	19·5
BEANS FOR STOCK- FEEDING OR SEED	83	93	96,322	121,174	17·2	15·3	16·3‡
PEAS FOR STOCK- FEEDING OR SEED	25	31	33,843	45,822	14·6 Tons	13·4 Tons	14·7‡ Tons
POTATOES	3,126	2,814	455,290	456,569	6·9	6·2	6·5
TURNIPS AND SWEDES	4,730	5,379	435,413	447,968	10·9	12·5	11·5
MANGOLDS ..	3,668	4,684	205,466	245,250	17·8	19·1	18·5

* Hay from Clover, Sainfoin and Grasses under rotation

† Hay from Permanent Grass.

‡ Peas and Beans harvested as Corn up to 1934.

* Published on December 22, 1937.

AGRICULTURAL RETURNS, 1937: PRODUCE OF CROPS

Corn Crops. *Wheat.* The area under wheat in 1937 was 1,731,833 acres, or 1.6 per cent. greater than in 1936, and the estimated yield per acre was 16.1 cwt. compared with 16.2 cwt. in 1936. The increase in the acreage, therefore, accounted for the increase in the total production from 1,378,000 tons in 1936 to 1,393,000 tons in 1937, or 1 per cent. All counties, with the exception of those of the North-Western Division and Northumberland, Durham, Dorset and Wales, showed yields below the average for the preceding ten years. The yield of 16.1 cwt. for the whole of England and Wales was 1.6 cwt. below the ten years' average.

Barley. Notwithstanding an increase of nearly 4,000 acres under this crop, a reduction in yield from 16.2 cwt. in 1936 to 14.0 cwt. in 1937, resulted in a decline in the total production from 663,000 tons to 576,000 tons, a decrease of 87,000 tons. The yield of 14.0 cwt. per acre over the whole country was lower by 2.2 cwt. than the yield returned in 1936, and 2.3 cwt. less than the average of the preceding ten years. Some fifteen counties in England and Wales showed very slight increases in yields, but all other counties recorded yields below the ten years' average.

Oats. The total acreage under oats decreased from 1,419,695 acres in 1936 to 1,223,098 acres in 1937. The yield per acre was estimated at 15.3 cwt. per acre, or 0.1 cwt. greater than in the previous year, and the total production decreased by 142,000 tons to 938,000 tons, a reduction of 13 per cent. The estimated yield for the whole country was 0.4 cwt. below that of the average of the previous ten years; and all divisions of England and Wales, except the South-Western and South Wales, showed declines from the ten years' average.

Mixed Corn. Although there was a decrease of 5,186 acres in 1937, the yield per acre was estimated at 16.2 cwt., or 0.8 cwt. greater than in 1936. The increased yield resulted in the total production, at 75,000 tons, remaining the same as in the previous year. All divisions, except the South-Western and the two divisions of Wales, recorded lesser yields than the averages of the preceding ten years.

Beans. The figures for beans relate to the crop harvested for stockfeeding or seed, the area of which fell from 121,174 acres in 1936 to 96,322 acres in 1937. The estimated yield per acre rose from 15.3 cwt. to 17.2 cwt., an increase of 1.9 cwt. per acre; but the reduced acreage resulted in a decrease in total production of 10,000 tons.

AGRICULTURAL RETURNS, 1937: PRODUCE OF CROPS

Peas. As with beans, the crop dealt with is that harvested for stockfeeding or seed. The area was reduced from 45,822 acres in 1936 to 33,843 acres in 1937, or 26 per cent. The estimated yield, at 14.6 cwt. per acre, however, was greater than in the previous year by 1.2 cwt. per acre; but the total production fell from 31,000 tons to 25,000 tons.

Hay. *Seeds Hay.* The area under clover, sainfoin, etc. for hay was returned at 1,466,783 acres, as against 1,338,849 acres in 1936. This increase in acreage, together with the increase in the estimated yield from 25.0 cwt. to 29.2 cwt. per acre, resulted in an increase in production of 467,000 tons over that of the previous year. The yield of 29.2 cwt. per acre was 2.8 cwt. higher than the ten years' average, nearly all counties in England and Wales having heavier crops.

Meadow Hay. The acreage under permanent grass for hay in 1937 was 4,674,995 acres, or 6,183 acres more than in the previous year. The yield per acre was estimated at 21.2 cwt. compared with 20.3 cwt. in 1936, and the total production increased from 4,733,000 tons to 4,967,000 tons, an increase of 234,000 tons, or 5 per cent. The yield per acre over the whole country was 1.8 cwt. greater than the ten years' average of 19.5 cwt.; all divisions showed increases over the previous year's yields.

Potatoes. The area under potatoes showed a reduction for the fourth year in succession, the acreage being returned at 455,296 acres, as compared with 456,569 acres in 1936. The estimated yield per acre, at 6.9 tons, showed an increase of 0.7 tons per acre, and as a result the total production was increased by 312,000 tons to 3,126,000 tons, a rise of 11 per cent. Compared with the average yield per acre of the preceding ten years, the yield in 1937 showed an increase of 0.4 tons per acre.

The figures given above relate to seeds and chats as well as ware potatoes, and include both first and second earlies as well as the main crop.

Roots. *Turnips and Swedes.* The decline in the combined acreage under these roots continued in 1937, when the area fell from 447,968 acres to 435,413 acres. The estimated average yield per acre fell from 12.5 tons per acre to 10.9 tons, and the total production from 5,579,000 tons to 4,739,000 tons,

AGRICULTURAL RETURNS, 1937: PRODUCE OF CROPS

a decrease of 17 per cent. The yield per acre of 10.9 tons was lower than the ten years' average by 0.7 tons, and only the South-Western division showed a very slight increase in yield over the ten years' average.

Mangolds. The acreage returned under this crop in 1937 was 205,466 acres, compared with 245,250 acres in 1936. The average yield per acre was estimated at 17.8 tons, or 1.3 tons lower than in the previous year, and 0.7 tons less than the ten years' average. The total production in England and Wales is estimated at 3,668,000 tons, a reduction of 1,016,000 tons. With the exception of the North-Western division and Wales, most counties shared in the general reduction in yield.

Sugar-Beet. The area under this crop was 305,690 acres, compared with 348,147 acres in 1936, a decrease of 42,457 acres or 12.2 per cent. The average yield per acre of washed and topped beet is provisionally estimated at 8.1 tons, or 1.6 tons less than in 1936.

MISCELLANEOUS NOTES

The Agricultural Index Number

The general index number of prices of agricultural produce for December is 132 (base December, 1911-13=100), or 1 point lower than a month ago, but 6 points above that for December, 1936. If allowance be made for payments under the Wheat Act, 1932, and the Livestock Industry Act, 1937, the revised index for the month becomes 136. Compared with November, average prices of barley, fat cattle, sheep and pigs, and poultry advanced, while those of wheat, oats, eggs, butter, potatoes and wool declined.

Monthly index numbers of prices of Agricultural Produce. (Corresponding months of 1911-13 = 100.)

Month	1932	1933	1934	1935	1936	1937
January	122	107	114	117	119	130
February	117	106	112	115	118	129
March	113	102	108	112	116	130
April	117	105	111	119	123	140
May	115	102	112	111	115	133
June	111	100	110	111	116	131
July	106	101	114	114	117	131
August	105	105	119	113	119	133
September	104	107	119	120	127	137
October	100	107	114	113	125	131
November	101	109	114	113	125	133
December	103	110	113	114	126	132

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and for the Cattle subsidy (b).

Month	1932	1933	1934	1935	1936	1937
January	--	111	119	124	125	133
February	--	110	117	122	123	133
March	--	106	112	118	122	134
April	--	109	116	126	128	143
May	--	105	116	117	120	136
June	--	104	114	117	121	134
July	--	104	117	120	121	134
August	108	108	122	120	124	136
September	108	111	125	128	133	142
October	104	112	121	119	129	134
November	105	113	120	119	129	137
December	107	114	120	120	130	136

(a) Commenced August, 1932. (b) Commenced September, 1934.

In the following table the monthly index numbers of prices of individual commodities are shown for the months of September

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to December, 1937, December, 1936, and December, 1935, base, the corresponding months of 1911-13=100.

Commodity	1937				1936	1935
	Dec.	Nov.	Oct.	Sept.	Dec.	Dec.
Wheat	116	120	124	114	118	77
Barley	160	152	148	147	115	100
Oats	119	120	124	125	101	83
Fat cattle	113	113	111	115	91	91
„ sheep	131	137	134	138	128	119
Bacon pigs	131	129	124	124	124	98
Pork „	139	137	131	125	131	110
Eggs	121	126	136	141	106	110
Poultry	130	132	133	130	119	120
Milk	181	181	171	202	171	171
Butter	110	116	111	109	98	93
Cheese	120	121	122	124	103	87
Potatoes	152	156	153	147	220	185
Hay	79	79	86	95	98	84
Wool	117	133	140	146	118	91
Dairy cows	121	119	120	117	111	104
Store cattle	112	107	111	113	98	92
„ sheep	112	116	129	138	113	106
„ pigs	159	167	164	153	156	131

Revised index numbers due to payments under the Wheat Act and to the Cattle subsidy.

Wheat	135	132	134	132	135*	124
Fat cattle	127	128	126	130	105	105
General Index	136	137	134	142	130	120

* Superseding figure previously published.

Grain. Wheat was 6*d.* lower on the month at 8*s.* 6*d.* per cwt. and the index is reduced by 4 points. (If the deficiency payment under the Wheat Act, 1932, is taken into account the index is 135.) Barley at an average of 13*s.* 2*d.* per cwt. averaged 3*d.* more and this, together with a reduction in the base period, caused the index to move upwards by 8 points. Oats at 8*s.* 4*d.* per cwt. realised 1*d.* per cwt. less money and the index falls by 1 point. In December, 1936, wheat averaged 8*s.* 8*d.*, barley 9*s.* 6*d.* and oats 7*s.* 1*d.* per cwt.

Live Stock. Quotations for fat cattle appreciated during the month under review, the average for second quality at 40*s.* 4*d.* per live cwt. being 2*s.* 6*d.* higher but, owing to a similar movement in the base months, the index remains unchanged at 113. With the addition of the subsidy under the

MISCELLANEOUS NOTES

Livestock Industry Act, 1937, the index becomes 127. Fat sheep at $10\frac{1}{2}d.$ per lb. for second quality, averaged $\frac{1}{2}d.$ more than in November but, with a more pronounced rise in the corresponding months of 1911-13, the index falls by 6 points. Both baconers at 13s. 1d. per score (20 lb.) and porkers at 15s. 1d. showed increases of 2d. per score and the indices rise by 2 points in each case.

Dairy cows and store cattle realized more money during the month and the relative indices advance by 2 and 5 points. Prices of store sheep also moved upwards but, on account of a greater increase in price having taken place during the base period, the index declines from 116 to 112. Store pigs were cheaper and the index is lower by 8 points.

Dairy and Poultry Produce. No change occurred in the regional price of liquid milk between November and December and the index continues at 181. Butter at 1s. $4\frac{1}{2}d.$ per lb. averaged $\frac{1}{2}d.$ less than in November, the index moving downwards by 6 points. Eggs at 20s. 5d. per 120 were lower in price by 1s. 10d. and the index is reduced by 5 points. The average price of cheese was again unchanged at £4 11s. per cwt. but, with a slight increase in the base months, the index is 1 point lower. All classes of poultry sold at higher prices but the combined index is reduced by 2 points.

Other Commodities. Quotations for potatoes were somewhat lower and the index moves downwards by 4 points. Clover and meadow hay were practically unchanged in price and the combined index remains at 79. Wool at 1s. $3\frac{3}{8}d.$ per lb. was $1\frac{7}{8}d.$ cheaper than in November and the index recedes by 16 points.

Handbook of Diseases of Animals Acts and Orders (1937 Edition)

A new Edition of the Handbook of the Diseases of Animals Acts, 1894 to 1937, and the Orders of the Minister of Agriculture and Fisheries made thereunder has recently been published. The format has been designed in such a way that the Handbook can easily be kept up to date by the insertion, within the eyeleted covers, of new Acts or Orders as they are issued. The volume is indispensable to all whose duties or work require their acquaintance with the regulations concerning diseases of animals, or who are in any way connected with the administration of the Acts and Orders.

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The Handbook includes an introduction describing certain diseases at present the subject of administrative action in pursuance of the powers conferred by the Acts, and giving a description of each disease, the names of the classes of animals that may be affected, the symptoms of such diseases, and in some instances the post-mortem appearances to be looked for.

Copies of all the Diseases of Animals Acts now in operation are included, including the amendments thereto enacted by the Dogs Act, 1906, and the Exportation of Horses Acts of 1914 and 1937; together with copies of other Acts connected with animals and poultry and having some bearing upon the Diseases of Animals Acts, e.g., the Protection of Animals Acts and the Slaughter of Animals Acts. The Orders contained in the Handbook include those relating to:—

- (a) the procedure for dealing with the notifiable diseases of animals;
- (b) the importation of animals, carcasses, hay and straw, and poultry and hatching eggs, dealt with from the point of view of the prevention of the introduction of disease;
- (c) the regulation of the exportation of pedigree stock through the London Quarantine Station;
- (d) the disinfection of livestock markets, saleyards, lairs and of railway and motor vehicles used for animals;
- (e) the protection of animals and poultry from avoidable suffering during transit by land and water;
- (f) the approval of disinfectants and sheep dips for animal disease purposes; and
- (g) therapeutic substances.

The Handbook may be purchased from the Sales Offices of His Majesty's Stationery Office, through any bookseller, or on personal application at the Ministry, 10, Whitehall Place, London, S.W.1, price 7s. 6d. (post free 8s. 1d.).

Agricultural Machinery Testing Committee

The Ministry undertakes to test agricultural implements and machinery with the object of furnishing accurate information regarding the utility, efficiency and reliability of each machine or implement tested. A leaflet (No.A396/T.G.) giving an outline of the scheme can be obtained, post free, from the Ministry. Certificates and reports embodying the results of each test are published in pamphlet form by His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2.

Under this scheme the following tests have recently been carried out.

The Clifton Electrically Heated Steam Boiler has been tested for general dairy and farm use. Tests of the boiler

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to determine the evaporation rate, heat balance, electrical consumption and steaming efficiency were carried out by the National Institute for Research in Dairying (University of Reading), Shinfield, near Reading.

The Official Certificate of Performance, together with the Report of the test have now been published in pamphlet form (Certificates and Reports No. 67) at the price of 3*d*.

The Halliday Oil-Fired Boiler and Sterilizing Chest has also been tested for general dairy and farm use at the National Institute for Research in Dairying. The tests for this plant were in two series: (1) tests of the boiler only in which evaporation rates, heat balance, fuel consumption and steaming efficiency were determined, and (2) tests of the complete equipment, under working conditions, in which measurements were taken of operating times with (a) the chest filled with tinned steel dairy utensils and (b) the chest filled with glass bottles.

A pamphlet giving results of the tests is now in the press and will be published shortly as Certificates and Reports No. 66.

The Darby Thatching Needle is the subject of the previous pamphlet in the same series. Tests with this thatching needle were carried out by the Institute for Research in Agricultural Engineering, University of Oxford, and the Northamptonshire Institute of Agriculture, Moulton. The main points investigated were: (1) the best method of securing the stitch, and (2) a comparison between thatching with the needle and the usual hand method.

This pamphlet is published as Certificates and Reports No. 65, at the price of 2*d*.

Wart Disease Immunity Trials, 1938

THE Ministry will continue during the coming season to test, at the Potato Testing Station of the National Institute of Agricultural Botany at Ormskirk, Potatoes and Potato Seedlings as to their immunity from or susceptibility to Wart Disease on the same conditions as in recent years. (See this JOURNAL, January, 1937, pp. 1003-1005.)

The entry form (No. 345 H.D.), obtainable from the Ministry, should be filled up and returned to the Potato Testing Station, Ormskirk, Lancs, *with the requisite fees*. Samples must be sent to that station *as early as possible, but in any case not later than March 5*.

MISCELLANEOUS NOTES

Stud Goat Scheme

This scheme was inaugurated in 1924 under the auspices of the British Goat Society and with the approval and financial assistance of the Ministry, with the object of improving the productive quality of milch goats kept by small holders, cottagers and other persons of similar position.

Before the introduction of the scheme, the he-goats whose services were available were frequently of indifferent quality owing to the owner's difficulty in securing the use of a first-class male at a low service fee. Under the scheme, the small goat-owner now has the assurance that the stud goat approved for his use has been examined by the British Goat Society's Inspector and found to be of high quality, and that consequently the female kids by the goat should be well worth rearing. A premium of 4s. is paid by the Society to the owner of each approved stud goat in respect of every female goat served. The grant payable to the Society by the Ministry is in respect of administrative expenses, travelling expenses incurred by the Society's Inspection Officer in the selection of stud goats and the premiums paid by the Society to stud goat owners. The maximum grant is £450 per annum.

When the scheme was first introduced the maximum stud fee charged was limited to 5s., but the maximum was reduced to 4s. in 1932 and has since remained unchanged. The benefits of the scheme are available to all owners of female goats, irrespective of whether they are members of the British Goat Society or not, provided that they come within the category of the small-holder or cottager class.

In the first season of operation, 73 goats were approved and registered under the Scheme, 882 services were given, and the premiums earned amounted to £187. For several years the scheme expanded steadily, and except for the years 1932 to 1934 the position secured has been well maintained. In 1933 and 1934 the Ministry was obliged to make a temporary reduction in the amount of grant-in-aid paid to the Society owing to the necessity for strict economy in public expenditure in consequence of the general financial stringency and, in order to meet this emergency the Society had to reduce the number of stud goats approved for premiums. In 1935 the amount of the Ministry's grant to the Society was restored to the 1932 figure and the number of stud goats entered and the amount of premiums earned by them again showed an increase.

MISCELLANEOUS NOTES

Particulars of the progress of the scheme since its commencement are given in the following table :

			<i>No. of Stud Goats Entered</i>	<i>Total No. of Services</i>	<i>Premiums Earned</i>	
1924	73	882	187	} at 5s. per service
1925	..	..	89	1,115	229
1926	..	..	104	1,603	301
1927	..	..	113	1,609	301
1928	..	..	108	1,844	323
1929	..	..	105	1,982	367
1930	..	..	104	1,614	311
1931	104	1,798	336	} at 4s. per service
1932	..	..	97	1,690	279
1933	..	..	89	1,716	270
1934	..	..	76	1,379	220
1935	..	..	92	1,576	258
1936	..	..	101	1,826	285

In his report on his tour of inspection last season the Inspector of the Society referred to the many expressions of gratitude by cottagers for the assistance they had received from the Ministry and the Society, and also to the general improvement noticeable during the last few years in the quality of the young stock in the districts served by the approved stud goats.

For the current breeding season, which terminates on February 28, 102 stud goats have been approved and registered; these are standing at various centres throughout the country, including 10 in Wales. The conditions of service and any other information regarding the scheme may be ascertained on application to the County Agricultural Organizers at their respective County Education Offices, or from the Secretary of the British Goat Society, The Cottage, Roydon, Diss, Norfolk.

APPOINTMENTS

Dr. E. W. Russell has been appointed Goldsmiths Company's Soil Physicist at the Rothamsted Experimental Station in succession to Dr. G. W. Scott Blair who has been appointed Head of the Dairy Chemistry Department at the National Institute for Research in Dairying, Shinfield, Reading.

Dr. H. L. A. Tarr, who during the past four years has been in charge of the investigations on the Brood Diseases of Bees at the Rothamsted Experimental Station, has been appointed to the Sir William Dunn Institute of Pathology, Oxford University.

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Hampshire : Mr. M. T. Cowland Cooper, B. Sc. (Agric.) has been appointed Assistant Dairy Officer, *vice* Mr. H. Hirst, N.D.A., N.D.D.

FARM WORKERS' MINIMUM RATES OF WAGES

Farm Workers' Minimum Rates of Wages.—A meeting of the Agricultural Wages Board was held at Kings Buildings, Smith Square, London, S.W.1. on January 17, 1938.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders :—

Essex. An Order cancelling the existing minimum and overtime rates of wages for male workers and minimum rates for female workers and fixing fresh rates in substitution therefor, came into operation on January 23, 1938, and continues in force until January 28, 1939. The minimum rates in the case of male workers of 21 years of age and over are 34s. 6d. (instead of 32s. 6d.) per week of 41½ hours in the weeks in which Easter Monday and Whit Monday fall, and 50 hours in any other week in summer; 31 hours in the week in which Christmas Day and Boxing Day fall and 48 hours in any other week in winter, with overtime unchanged at 9½d. per hour on weekdays (including Easter Monday, Whit Monday, and Boxing Day) and 10½d. per hour on Sundays and on December 27, 1938. The minimum rate for female workers of 21 years of age and over remains unchanged at 6½d. per hour for all time worked.

Lincolnshire (Holland). An Order cancelling the existing minimum and overtime rates of wages and fixing fresh rates in substitution therefor, came into operation on January 30, 1938, and continues in force until further notice. The minimum rates in the case of male workers of 21 years of age and over are 37s. 6d. (instead of 36s.) per week of 39½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter; 41 hours in the weeks in which Easter Monday, Whit Monday and August Bank Holiday fall, and 50 hours in any other week in summer. In the case of horsemen, cattlemen and shepherds of similar age additional weekly sums are fixed to cover all time worked in excess of the number of hours mentioned above, except employment which is to be treated as overtime employment. The overtime rates in the case of male workers of 21 years of age and over are unchanged at 1s. 1½d. per hour on Sundays and Christmas Day, 9d. per hour on Easter Monday, Whit Monday and August Bank Holiday, and 10½d. per hour for all other overtime employment. The minimum rates for female workers of 15 years of age and over are unchanged at 6d. per hour with overtime unchanged at 7d. per hour for all employment in excess of 5½ hours on Saturday or other agreed weekly short day, on Sundays and in excess of 8 hours on any other day.

Lincolnshire (Kesteven and Lindsey). An Order fixing minimum and overtime rates of wages for male workers and minimum rates for female workers, came into operation on January 30, 1938 (i.e., the day following that on which the existing rates expired) and continues in force until January 28, 1939. The minimum rates in the case of male workers of 21 years of age and over are (i) Wagoners: 41s. 6d. (instead of 40s.) per week of 52½ hours in the weeks in which Good Friday and Boxing Day fall, 50 hours in the weeks in which Whit Monday and August Bank Holiday fall, 58 hours in any other week in the period from May 14 to October 14 and 61 hours in any other week during the remainder of the year; (ii) Shepherds: 39s. 6d. (instead of 38s.) per week of 45½ hours in the weeks in which Good Friday, Whit Monday and August Bank Holiday fall, 55 hours in any other week in summer,

FARM WORKERS' MINIMUM RATES OF WAGES

47½ hours in the week in which Boxing Day falls and 56 hours in any other week in winter with additional payments for the lambing season ; (iii) Stockmen : 40s. 6d. (instead of 39s.) per week of 46½ hours in the weeks in which Good Friday, Whit Monday and August Bank Holiday fall, 56 hours in any other week in summer, 49½ hours in the week in which Boxing Day falls and 58 hours in any other week in winter ; and (iv) Other Male Workers : 34s. 6d. (instead of 33s.) per week of 41 hours in the weeks in which Good Friday, Whit Monday and August Bank Holiday fall, 50 hours in any other week in summer, 39½ hours in the week in which Boxing Day falls, and 48 hours in any other week in winter ; with overtime in the case of all classes of male workers unchanged at 10d. per hour on weekdays and 1s. on Sundays. Provision is made for an adjustment of the hours in respect of which the minimum weekly wage is payable in the week in which Easter Monday falls to meet cases where a holiday is given in that week instead of in the week in which Good Friday falls. In the case of female workers of 17 years of age and over the minimum rate is 6d. per hour for all time worked (instead of 5½d.).

Suffolk. An Order varying the existing minimum and overtime rates of wages for male workers and minimum rates for female workers, the rates as varied coming into operation on January 23, 1938, and continuing in force until further notice. The minimum rates in the case of male workers of 21 years of age and over are 34s. (instead of 32s. 6d.) per week of 50 hours in summer, except in the weeks in which Good Friday and Whit Monday fall when the hours are 41½, and 48 hours in winter, except in the weeks in which Christmas Day and Boxing Day fall, when those days fall in separate weeks, when the hours are 39½, and in the week in which Christmas Day and Boxing Day fall together when the hours are 31, with, in addition, in the case of horsemen, cowmen and shepherds of 18 years of age and over a sum of 6s. per week to cover employment up to 10 hours per week in connexion with the immediate care of animals. The overtime rate for all male workers of 21 years of age and over is unchanged at 9½d. per hour. The minimum rate for female workers of 21 years of age and over is 6d. per hour (instead of 5d.) for all time worked.

Enforcement of Minimum Rates of Wages.—During the month ending January 12, 1938, legal proceedings were taken against three employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow :—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers involved
Carmarthen Gloucester Yorkshire (E. R.)	Llangadock Whitminster Escrick ..	£ s. d. (A)	£ s. d. —	£ s. d. —	1
		9 0 0	5 5 0	107 4 5	5
		1 0 0	0 6 6	7 8 8	1
		10 0 0	5 11 6	114 13 1	7

(A) = Dismissed.

FOOT-AND-MOUTH DISEASE

Foot-and-Mouth Disease.—Since the last issue of the JOURNAL the following areas have been released from restrictions :—

West Sussex (Petworth) ; Essex ; Soke of Peterborough, Northampton and Huntingdon ; Cheshire (Churton) ; and Northumberland (Morpeth).

Ninety-one further outbreaks of disease occurred during the period December 21 to January 19 inclusive.

Outbreaks which occurred at Lyndhurst, Hampshire, on December 23 ; Rowde, Wilts, on December 26 ; Stratton St. Margaret, Wilts, on December 29 ; Trowbridge, Wilts, on January 1 ; Marnhull, Dorset, on January 2 ; Spettisbury, Dorset, on January 14 ; and Hatherston, Hants, on January 16, necessitated extensions of the existing Dorset, Wilts, etc. Infected Area, in which area 75 outbreaks were confirmed during the period under review. This area now comprises a combined area of approximately 15 miles round the infected places at Marnhull, Spettisbury and Hilton, Dorset ; Trowbridge, Woodborough and Upavon, Wilts ; 10 miles round Hatherden, Hants ; and 5 miles round Stratton St. Margaret, Wilts.

Five further outbreaks also occurred in the Kent and East Sussex Infected Area. This area has, however, been contracted so as to comprise two separate areas of approximately 5 miles round infected places at (1) Stone-cum-Ebony, St. Mary in the Marsh and Stanford, Kent ; and (2) Clayton and Burgess Hill, East Sussex. It is hoped that on January 22 the latter area will be released from restrictions and the former will be contracted so as to comprise an area of approximately 5 miles round St. Mary in the Marsh and Stanford, Kent.

On December 25, disease was confirmed at Laleham, Middlesex, but as no further outbreak was confirmed in this area the restrictions were withdrawn on January 16.

Other outbreaks which were confirmed necessitated the declaration of Foot-and-Mouth Disease Infected Areas as follows :—

Norfolk, Suffolk and Essex. Approximately 15 miles round the infected places at Brundish, Suffolk ; Kenninghall, Norfolk ; and Shelland, Suffolk. This area has since been contracted so as to comprise two separate areas of approximately 5 miles radius round the infected places at Kenninghall and Shelland. These areas will be released from restrictions on January 23 and January 25 respectively.

Somerset and Dorset. Approximately 15 miles round the infected places at Limington and Wedmore, Somerset, and 5 miles round Beer Crocombe, Somerset.

Derby and Yorks (W.R.). Approximately 15 miles round an infected place at Dore, Sheffield. This area will be contracted to one of approximately 5 miles radius on January 22 and released on January 29.

Berkshire, Oxford and Wiltshire. Approximately 15 miles round the infected places at Steventon and Milton, Berks.

The dates given above for contraction or release are dependent upon there being no further outbreaks in the areas concerned.

WIRELESS TALKS, FEBRUARY, 1938

<i>Station and Date</i>	<i>Time p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National :			
Feb. 2	6.20	Mr A. Hurd	Where Does Farming Stand ?
" 9	6.20	" "	Marketing Schemes.
" 16	6 20	Mr A Hurd and Mr Baxton	The Milk Scheme. (Discussion.)
" 23	6.20	Mr. A. Hurd and Mr. Fox	The Pig Scheme. (Discussion).
North :			
Feb. 11	6.40	Prof. J. A Hanley and Mr. W. Lyle Stewart	Sheep Diseases. (Discussion)
" 25	6 40	Mr James Strachan	Turnips and Swedes.
Midland :			
Feb. 3	6 0	Principal Henry Robinson and Mr. J R Lambley	The Agricultural Workers. (Discussion)
" 18	6 40	Mr. W A. Stewart	Spring Feeding.
West :			
Feb 3	6.45	A Young Farmer and Mr. H. W. Tomlinson	Lambing and the Management of the Ewe Flock.
" 10	8.0	Mr. A. W. Ling	Review of Past Year.
" 17	6.45	A Young Farmer and Mr. W D. Hay	Grass Land
" 24	9.15	Mr Kearns and Mr. A. W. Ling	Insect Pests
Welsh :			
Feb. 11	7 30	Mr. J. L. Lloyd and Messrs. W Jones, D. J Rees and H. Williams	Labour on the Land (Discussion)
Scottish :			
Feb 3	6.10	Mr S. J Edwards and Mr F A Bell	Mastitis (Discussion)
" 11	6.50	Mr Alan Frazer	—
" 17	7 50	Mr W. J. Campbell	Seed Potatoes
" 24	6 15	Mr W. Smith	Spring Manuring
Northern Ireland :			
Feb. 7	7.30	Mr. P. Fitzpatrick	Farmers' Work and Worry.
" 14	7 30	(Discussion)	Creameries
" 21	7.30	Mr. P. Fitzpatrick	Farmers' Work and Worry.
" 24	7.30	Debate	Young Farmers.
" 28	7.30	Mr. H. O'H. O'Neill	Problems in Byre and Dairy.

NOTICES OF BOOKS

Changes in the Economic Organization of Agriculture. A Comparative Study of Conditions in the Eastern Counties of England in 1935 and 1936. Farm Economics Branch Report No. 24. (Cambridge: School of Agriculture. 1937. Price 1s. 6d.; post free 1s. 8d.)

This report is the second of a series of which the object is to examine changes occurring from year to year in the organization of farms in the eastern counties of England. Its predecessor (Report 23, reviewed in this *Journal* for August, 1936) was concerned with conditions in 1933 and 1935. The present report compares conditions in 1936 with those in 1935 over an identical group of 200 farms. This sample comprises commercial diversified livestock and crop farms over 20 acres in area, and has been selected at random from four important "type of farming" districts within the eastern counties. The report suggests that the results shown in it are probably reasonably representative of the financial and economic changes that have taken place within the types of farming covered: but it is not claimed that they describe conditions throughout the province as a whole.

The report shows that the average profit obtained in 1936 by the 200 farms was better than in the previous year, but that the improvement was confined almost entirely to one of the four "type of farming" districts. On the Central Norfolk medium loams there was a decrease in profits; on the arable clays of North Essex and South-west Suffolk and on the South Essex pasture clays, only a small improvement was recorded; profits on the South Cambridge chalklands alone show a substantial increase. The report hazards the opinion that, for the province as a whole (excluding the Fens), farm profits in 1936 were similar to those of 1935.

The careful studies in this report and the technique of inquiry and analysis of data will be of interest not only to students of the Eastern Counties but to all those interested in farming conditions throughout the country.

Economic Botany, a Textbook of Useful Plants and Plant Products.

By A. F. Hill. Pp. xxi + 592 and 225 figures. (New York and London: McGraw Hill Publishing Company, Ltd. 1937. 24s.)

This book is the latest addition to the well known and useful publications of the McGraw Hill Publishing Company in the agricultural and botanical sciences. In the introduction the author, who is research assistant in economic botany at Harvard University, deals in general with the importance and nature of plant products. He shows how the three great necessities of life—food, clothing and shelter—as well as a host of other useful products are supplied in great measure by plants, and states that from the earliest times plants have been intimately bound up with human existence and have not only played an important part in the everyday life of mankind but have had a profound influence on the course of history and civilization.

The volume consists in the main of four sections—"industrial plants and plant products," "drug plants and drugs," "food plants" and "food adjuncts." These are followed by an appendix in the form of a systematic list of the species discussed, and a bibliography and full index. Under "industrial plants and plant products" are fibres, forest products and resources, tans and dyes, rubbers, gums and resins, essential oils, fatty oils and waxes, sugars, starches and cellulose products. Insecticides, such as pyrethrum, derris, and cube (*Lonchocarpus*) are under medicinal plants,

NOTICES OF BOOKS

while a separate chapter "fumitories and masticatories" includes, of course, tobacco. The section on food plants and food adjuncts includes chapters on major and minor cereals, legumes and nuts, vegetables, fruits, spices and beverage plants. The treatment of each species or product throughout the work varies in length according to its importance. A full treatment of each would have necessitated a work of several volumes. About 800 species are dealt with in all, an attempt having been made "to include the most important plants of America and other parts of the world insofar as they enter into international commerce." Greater stress has perhaps been laid on those plants that are of particular importance in the United States or of American origin, but the book is intended to be used as a text-book for American students. Material of a technical nature has been avoided as far as possible, so the work should have an appeal to the ordinary reader, for, as the writer states, "a knowledge of the industrial, medicinal and edible plants cannot fail to broaden one's outlook." It is certainly one of the best general treatises on economic botany that have so far appeared.

The Preservative Treatment of Estate and Farm Timber. By R. C. B. Gardner. Pp. 36 and 6 Figs. (London: British Wood Preserving Association, 48, Dover Street, W.I. 1937. Price 6d.)

This useful pamphlet, now in its second edition, explains in simple non-technical language various practical methods of preserving timber, giving details of the preservatives recommended, with cost of plant, preservatives and treatment. The importance of the subject is still insufficiently realized. In the event of loans being raised for timber structures, more advantageous terms are offered when the timber is treated with a preservative, a fact which is in itself significant. The small farmer's labour is usually fully occupied, and it is therefore more practical that he should purchase his timber already creosoted, or otherwise treated with preservative. The cost of plant for the more elaborate methods of treating timber will be found prohibitive except on the largest estates, but the ordinary vertical butt-drum for fencing posts and the horizontal tank for cold steeping should be within reach of all. The final appendix contains references to published work on the subject, which should prove very helpful as a guide to further study.

The Biochemistry of Cellulose, The Polyuronides, Lignin, etc. By A. G. Norman, Ph.D., D.Sc. Introduction by Sir E. John Russell. Pp. ix. + 232. (Oxford: Clarendon Press. 1937. Price 15s.)

A fattening bullock of 11 cwt. live-weight, subsisting on a ration composed of meadow hay, oat straw, silage, sugar beet pulp and concentrates, may consume as much as 6 lb. of fibre daily. The question of the part which cellulose and lignin, the essential components of fibre, play in the nutrition of animals is, therefore, one of extreme importance to the feeder of live-stock. Is the function of the bulky, fibrous food merely that of filling the capacious rumen of cattle and sheep, conferring thereby the desired feeling of contentment and repletion after feeding? Or, on the other hand, is the fibrous constituent of feeding stuffs able to undergo, during digestion, transformation into nutrients capable of contributing to maintenance and production in the animal?

Kellner has supplied the answer to these questions. By means of experiments with bullocks in respiration chambers he has shown that if 1 lb. of pure, finely-divided cellulose be added to the maintenance ration of a bullock, it will form as much fat in the body of the animal as would be produced by feeding 1 lb. of starch or other forms of digestible polysaccharide. The starch equivalent of digestible cellulose is unity.

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The explanation of this equivalence between cellulose and starch has so far eluded the scientific worker. The solution lies in a more complete understanding of the complex make-up of the cellulose molecule and the changes that it undergoes in the digestive tract of the ruminant animal. A vast amount of research has been carried out in recent years on the chemical and nutritional aspects of cellulose, not only by the pure chemist and the bio-chemist, but also by the technical chemist, for no substance finds more applications in industry than does this primary constituent of the plant world.

Dr. Norman has earned the gratitude of all chemists and physiologists by the concise and able manner in which he has brought together in one volume all the manifold results of recent research in this difficult domain. The student is now spared the onerous task of reading through an enormous number of publications in a wide range of scientific journals in his attempts to arrive at the present position of knowledge in relation to the chemistry of cellulose and such related compounds as hemicelluloses, pectins, pentosans, mucilages, gums and lignin.

The author's treatment of the subject leaves nothing to be desired, and amply justifies Sir John Russell's assertion in the foreword: "Dr. Norman has the triple qualification of wide knowledge of the subject, a sound critical faculty that enables him to put the material into proper perspective, and a gift of lucid exposition." The volume is sure of a warm welcome from the research worker and the general student of science.

Pork Production. By William W. Smith, M.S.A. Revised edition. Pp. xxii + 575 and 88 Figs. (London: Macmillan & Co., Ltd. 1937. Price 16s.)

The American expression "pork production" means, in English, "pig production," and it must not be imagined that this is a manual on the production of what is known in this country as pork, as distinct from bacon and hams. The publication is a revised edition of the book which Professor Smith first published in 1921, but it is now nearly twice the original size and has been practically rewritten. In addition to the original material it now summarizes the experimental feeding data that have accumulated in the United States since 1921, and attempts to apply the results of the extensive fundamental studies in nutrition of the last twenty years. As a work of reference for professional teachers and scientific workers it will be found comprehensive and up to date. For British workers, however, it will have the disadvantage that it deals exclusively with American conditions. The outstanding part played by maize in the production of American pigs is evident on almost every page, and rather overshadows the relative importance of other factors.

The highly-documented summaries of experimental work are in the best tradition of this class of work, and the chapters on management are also to be recommended. There is an excellent study of the factors affecting litter size, and the fundamental principles of nutrition receive careful and detailed attention. Professor Smith is to be congratulated on dealing scientifically with the use of food refuse, a subject almost invariably passed over in English books with the suggestion that swill feeding is to be avoided at all costs. In the United States it has been shown that 1 ton of swill will produce 50 lb. of live-weight gain in times of prosperity, but only 24 lb. when times are hard and less is thrown into the swill tub.

All aspects of production are covered in this interesting book, but in some chapters there is such a wealth of figures from experimental results that it is to be regarded as a work of reference for specialists, rather than as a consecutive description of pig production for the average farmer.

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The XXIIInd Annual Report of the Experimental and Research Station, Cheshunt. Pp. 104. Illustrated. (Issued by the Nursery and Market Garden Industries' Development Society, Ltd., Turner's Hill, Cheshunt, Herts.)

This Report records the results of experiments with tomatoes, cucumbers, lettuce and mushrooms, and of investigations in connexion with plant diseases, animal pests and manurial treatments. The year was noteworthy for the inauguration of a campaign to improve the quality of tomatoes, details being given in the report. Among other interesting matters may be mentioned an account of an invader of mushroom beds, new to Britain, viz., the truffle fungus, *Pseudobalsamia microspora*; a record of a new disease of the tomato caused by *Anguillulina dipsaci*; and a comprehensive article on "Water-spot" of tomato fruits.

Land Classification in Dorset. By L. Ellis Tavener, M.A. Inst. of Brit. Geographers, Publ. No. VI. Pp. vi + 61. Maps and diagrams. (London: George Philip & Son Ltd. 1937. Price 7s. 6d.)

Surveys, of one sort and another, of the agricultural land of this country, relating to districts or to the whole country, have become quite the fashion. So much work has been done, that it is indeed time to decide upon the best method to adopt and then to collate the results of the various surveys on that method or expand them into conformity with it.

Mr. Tavener has pointed out how badly a complete survey is needed. There is a fundamental problem in the country, the interpretation of research findings in terms of the most efficient use of our national resources. Lack of exact knowledge of the present use of the land, which has resulted from the accumulated experience of working farmers gained through centuries of trial and error, prevent the immediate application of new scientific data to the modification of that use. Such modification, perhaps in the way of change in use, perhaps only in intensified use along the same lines, would, Mr. Tavener seems to imply, come more rapidly if the geographer possessed the detailed knowledge of the agricultural use of our land that he ought to have.

With such knowledge it should be possible to define, or at least to outline, the most profitable types of development for any particular area, and thereby to provide a basis for any agricultural policy endeavouring to meet changing social and economic conditions. For these reasons Mr. Tavener emphasizes the necessity, at the present time, for a complete set of county surveys which could be made available to those responsible for advising on profitable changes in agricultural policy and land utilization. Few will not sympathize with this desire for exact knowledge and its use.

Mr. Tavener's own work is in a sense an attempt to implement his own suggestion so far as the county of Dorset is concerned, and his survey is an example of a valuable method, but not perhaps the only method, which might be adopted if such county surveys were to be initiated. As might be expected he found that the boundaries of the types of "land-use" units in Dorset correspond closely with those of natural land types, and this will probably prove true of other counties if they are surveyed on the same principles. This does not inhibit the value of such a series of surveys, which would be likely, as Mr. Tavener assumes, to provide the data for the more rapid application of the findings of the various departments of agricultural science.

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Sugar : A Case Study of Government Control. By John E. Dalton. Pp. x + 311. (London : Macmillan & Co., Ltd. 1937. Price 12s. 6d.)

The author of this book was Chief of the Sugar Section of the Agricultural Adjustment Administration in the years 1934 and 1935 when the administration of the Jones-Costigan Sugar Act was in its early stages, and so was well qualified to undertake this survey of the United States sugar industry with particular reference to the measures for Government control that have come into force under the Roosevelt administration. The author has subsequently been Professor of subjects pertaining to business and government in the Harvard Graduate School of Business Administration, and in this capacity he found that the "Case of Sugar" presented an excellent illustration of some of the issues which arise when the central Government attempts to formulate and administer plans for the assistance and regulation of industry ; accordingly, in the final chapter of this book, some of the wider questions as to the relationship between government and industry are discussed in the light of experience of the particular problems of the sugar industry.

The author stresses the complexity of the United States sugar industry, which consists of (i) the beet sugar industry of the western States, (ii) the cane sugar industry in Louisiana and Florida, (iii) the cane sugar industries in the various Insular Areas, viz., Hawaii, Puerto Rico and the Philippine Islands, and in Cuba, all dependent to a different degree politically and economically on the continental United States, (iv) the sea-board refiners in the continental United States. Each section of the industry has its own peculiar organization, and the interests of the several sections are often at variance. One common factor, however, has been their dependence on Government assistance, at different times and in different degrees, for the maintenance of the immense resources of capital and labour invested in the industry.

Up to 1933 that assistance had been given by means of a tariff, and Mr. Dalton outlines the reasons why in 1933 a simple tariff was deemed to be inadequate to deal with the particular problems of the American sugar industry. A voluntary stabilization agreement was drawn up by the industry in 1933 under the provisions of the Agricultural Adjustment Act, but this was rejected by the Secretary of Agriculture. The greater part of the book is devoted to a review of the working of the Jones-Costigan Sugar Act of 1934, which filled the gap left by the rejection of the industry's own scheme. This Act provided for the division of the market for sugar in the United States between continental beet and cane producers, the various Insular Areas, Cuba and other foreign countries, by a quota system. The Secretary of Agriculture has to determine the consumption requirements of the continental United States, and the figure determined has a considerable influence on the internal price of sugar. The Act also provides for the production control in the continental United States and the Insular Areas and a system of benefit payments to producers who reduce their output (these payments were subsequently invalidated by a decision of the Supreme Court). In addition there is a tariff on foreign sugar with a preference for Cuba. The author estimates the total amount of assistance which the sugar consumers of the United States give to the industry at approximately \$250,000,000 per annum.

There is no index to the book, but this deficiency is partly compensated for by a fairly full list of contents at the beginning.

Milk Consumption. By K. A. H. Murray. Pp. 64. (Oxford : Issued by the Agricultural Economics Research Institute. 1937. Price 2s. 6d.)

This brochure by Doctor Murray will be invaluable to students of the milk industry, particularly those concerned with problems of consumption.

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It is divided into three sections. The first gives a useful summary of existing analyses of the factors affecting milk consumption. The second describes a house-to-house survey of the consumption of milk and milk products carried out in Oxford during the summer of 1936. The information acquired has been treated to detailed statistical analysis. Part three summarizes the results of the inquiry and gives the Author's conclusions.

Although it would not be claimed that Oxford is typical of the country as a whole in regard to its consumption of milk, Doctor Murray's inquiry and his conclusions cannot fail to be of interest to all students of the subject.

The inquiry showed that the consumption of milk in different households varied over a very wide range, from no milk at all in some instances to 59 pints a week in one house. The rate of consumption per head was even more variable, ranging from nothing to over 14 pints a week, the average being about 4 pints. Information of this character, though limited to one town, will probably be of general interest, and Doctor Murray's treatment of the subject will, it is to be hoped, be found useful and suggestive to other inquirers in this interesting and important field of research.

Conservation of the Soil. By A. F. Gustafson. Pp. xviii + 312 and 197 Figs. (London: McGraw-Hill Publishing Co., Ltd. 1937. Price 18s.)

The lengthening list of new books on different aspects of soil conservation is a proof of the serious attention being given to this problem in the United States of America. The American nation has become "soil conscious," and, although the steps that are being taken to combat the menace of soil deterioration are to some extent party-political in character, there is a general agreement that the soil must be protected against further losses.

The main facts of the problem and the principles of soil protection are fairly well established. Yet it is an advantage to have the subject treated by different authors from their own viewpoints. Professor Gustafson writes on the subject with the aid of a long field experience of soils and their behaviour, and his book will be interesting and profitable even to those who are already familiar with other works on the subject.

The first three chapters are devoted to a statement of the nature and results of soil erosion. In the next four chapters the factors affecting erosion are systematically treated. These factors fall into five groups, namely: (i) nature and amount of rainfall; (ii) slope; (iii) character of soil; (iv) vegetation cover; and (v) cropping and tillage. The section on rainfall contains remarkable data, shown diagrammatically, on the expectation of different intensities of rainfall in different parts of the country. For example, in the coastal regions near the Gulf of Mexico a rainfall of 3.5 in. in an hour may be expected once in 25 years. It could be wished that the section dealing with the influence of the soil itself were fuller. Unfortunately our knowledge of this aspect of the problem is still insufficient. The effect of organic matter in diminishing liability to erosion is well known, but it is probable that this effect is qualitative as well as quantitative. The structural stability of soil newly-ploughed out of prairie or grass land is probably not a simple function of the actual amount of organic matter present. The main body of the book, nearly 200 pages, deals with methods of soil conservation. These methods are described and discussed in a readable and interesting manner, free from unnecessary detail. The concluding chapters deal briefly with erosion on highways and with flood control. The latter problem is closely bound up with the problem of soil erosion: a satisfactory control of erosion

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would inevitably reduce the severity of floods. One of the most desirable consequences of such control would be a reduction in the burden of suspended matter in rivers and a check to the silting up of reservoirs and the perilous raising of river levels.

The book is written in an attractive style and is lavishly illustrated with excellent plates and diagrams. Whilst soil conservation in the sense of the present book is not a serious problem in this country, British agriculturists will derive instruction and profit by learning how American agriculturists are dealing with their most serious problem. To agriculturists in our overseas Empire the importance of such a work as this is obvious.

Prosperity and Depression. By G. von Harberler. Pp. xv + 363. (Geneva: League of Nations. 1937. 7s. 6d.)

This book has been prepared by Dr. von Harberler for the Economic Intelligence Service of the League of Nations, and represents a first step in co-ordinating the research work that is being done in many countries upon the problem of the trade cycle. Its main purpose is to examine, classify and synthesise the existing theories of the causation of the trade cycle, and of its course and phases, preparatory to the detailed statistical analysis which will follow. In the first half of the book Dr. von Harberler reviews all the more reputable theories now extant, not in order to accept or dismiss any of them, but chiefly to discover and classify the resemblances and dissimilarities that remain after removing differences of terminology and the like. In the second half he attempts a general synthesis, which is based largely on the common elements in the theories reviewed; but this is not a mere patchwork, and sufficient judgment has been used to combine the common elements into a coherent whole.

Although the book is best read with the advantage of some previous acquaintance with the subject of the trade cycle, it is by no means intended for specialists only. The general reader will particularly profit from what is perhaps the outstanding feature of the work—its exposition of the subject in a form that makes the most of the quite extensive common ground among almost all economists.

A Study of Fluid Milk Prices. By J. M. Cassels. Pp. xxvii + 304, and 46 Figs. (Oxford University Press. Cambridge, Mass.: Harvard University Press. 1937. Price 17s.)

This book is a study of milk prices in some of the most important eastern markets of the U.S.A. during the period 1917 to 1932, although the price structure in certain markets has been dealt with from 1910 to 1932. The work thus omits any reference to the fluid milk programme of the Agricultural Adjustment Administration. The early part of the book is a theoretical study of demand and supply factors in their relation to milk prices and, as such, is not of particular interest to the average producer.

Chapter VI is one of the most important sections in relation to England and Wales as it deals with the various price plans adopted to distribute the returns from the sale of milk equitably between producers who form a group or those who supply a particular market. Three price plans are discussed, the class-price plan, the base-rating plan and the classification and rating plan.

In the section dealing with consumption and demand, it is pointed out that the per capita consumption of liquid milk and fresh cream in cities in the United States increased from 38·1 to 40·8 gal. between 1921 and 1929. The most important factors that gave rise to this increased consumption are said to be higher incomes; improvement in the quality of milk; advertising and educational work, especially in schools; and prohibition. The statement is made several times that the demand for milk is inelastic,

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although this conclusion is apparently based on small price change generally 1 cent per quart—and is thus less conclusive than the writer suggests. Demand is, however, less inelastic among the lower income-earning classes than the higher, and for shop purchases than for door-to-door deliveries.

Further sections deal with distributive margins and transport costs, both of which tend to be much more rigid than either wholesale or retail prices. An interesting chapter compares the gross returns of producers from the sale of fluid milk in ten cities with the computed returns for milk of the same quality used for manufacturing purposes. The returns for liquid milk were higher than those for manufacturing milk, by margins varying from over 50 per cent. down to 16 per cent., and averaging about 20 to 25 per cent.

The two main reasons for the higher gross returns for liquid milk are said to be the greater cost of producing milk for the liquid market owing to the higher sanitary standards required, and the bargaining power of the producer-organizations selling fluid milk.

Compared with conditions under the English scheme it might be noted that :—

- (i) The advantages of the pooling system are only shared by producer-members of milk organizations.
- (ii) Organized groups may be in direct competition with each other.
- (iii) Prices fixed by agreement between producers' organizations and distributors may be undercut by non-member producers.

As, however, the margin between the prices of milk sold for liquid consumption and for manufacture are smaller than in this country, the effects of undercutting are less serious.

Farming England. By A. G. Street. Pp. viii + 120, and 135 Figs. (London : B. T. Batsford, Ltd. 1937 Price 7s. 6d.)

The literature of farming, written expressly for the purpose of informing our urban population, grows by leaps and bounds. Some of it is very amateur, but A. G. Street's position as a farmer who knows and loves his profession at once removes anything he writes out of that category. His earlier writings are widely known and appreciated, but in this book he has once again left the romantic aspect of farming in order to write a critical survey of its practice in the different parts of our country.

The book is written clearly, and emphatically, and, following as it does *Regional Types of British Agriculture*, a book written by a group of advisory and other officials, it invites comparison with that work : but a comparison is nevertheless difficult. One man travelling the whole country cannot hope to secure so intimate an acquaintance with the details of farm management in any particular area as an adviser whose life has been spent there and whose work demands that he shall be acquainted with all the idiosyncrasies of that district. Nevertheless, in general outline Mr. Street has seemingly achieved this impossibility. Whatever district he describes he seems to have got at the heart of the matter, and his simple, unembellished style of writing makes his readers feel that they too have been told all that he has learned.

Farming surveys are extremely useful at this present time, and, when written with so much character as this one, serve a purpose greater than that of informing the general urban public of the situation of the rural people, their ways and their days : the book brings into perspective the different branches of farming and is not too kind to governmental policy ; nevertheless it can unhesitatingly be recommended to all who are interested in one of the foremost problems in our national economy, the problem of our agriculture and the people who are engaged in it.

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Overseas Plant Products. By J. H. Holland. Introduction by Sir Arthur W. Hill, K.C.M.G., Sc.D., F.R.S. Pp. vii + 279. (London: John Bale, Sons & Curnow, Ltd. 1937. Price 6s.)

The items enumerated in this volume comprise all natural products of vegetable origin imported on a commercial scale into this country. Samples of such products are frequently received for identification at Kew from business houses, generally accompanied only by names used in their country of origin, these affording little clear indication of identity. While the author was on the staff of the Royal Botanic Gardens his duties included the identification of such specimens, and the results of his labours in this direction are now published in book form. Trade and vernacular names are correlated with the botanical (specific and family) names and the trade sources or countries of production, and some indication is given as to uses. There is a bibliography of drugs, medicinal and culinary herbs, and a commendatory introduction by the Director of the Royal Botanic Gardens at Kew, under whose auspices the work appears.

Records of a Yorkshire Manor. By Sir Thomas Lawson-Tancred, Bt. Pp. x + 384, and 6 Maps. (London: Edwin Arnold & Co. 1937. Price 21s.)

The editor of these documents confesses that he has not been able to transcribe them in full, but he has tried to give a selection of extracts that would be an indication of the history of the manor from early mediæval times until the nineteenth century. It is always unsatisfactory when an editor makes selections of documents, but historians must be grateful to any editor who undertakes to print a long series of documents that is not readily accessible to the ordinary student.

Only a small section of this publication deals directly with agricultural history, and that not very directly with farming processes. It would probably be difficult to interpret even such documents as may not have been printed here in such a way as to learn exactly how the farming was done in the manor, but from the point of view of the agrarian historian such an attempt would have been of great value.

This mild criticism is not intended to depreciate the value of what is printed, which is of great interest both from a social and administrative point of view. In connexion with the former, an interesting inventory of the contents of Boroughbridge Hall in 1718 is printed. This indicates not only the contents of the house, but the number of rooms and their uses. On the administrative side, practically the whole of the documents could be called upon to supply evidence, and it is to the student of local and central administration that this book will, on the whole, make the most appeal.

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THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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Agricultural Research Council

Farmers and others interested in agriculture have sometimes expressed the view that insufficient information is available about the activities of the Agricultural Research Council. To meet what they recognize as an important need, the Council have issued a booklet entitled "Constitution and Functions of the Agricultural Research Council."*

The booklet contains an interesting account of the methods that have been adopted by the Council to fulfil the task entrusted to them in 1931 when they were established by Royal Charter. The work of the Council is carried out under the direction of a Committee of the Privy Council, of which the Lord President is Chairman, and the Council are responsible for tendering advice to the Ministry of Agriculture and Fisheries, the Department of Agriculture for Scotland and the Development Commissioners on the expenditure on agricultural research of State funds amounting to more than four hundred thousand pounds yearly. The Council are also charged with the scientific supervision of subsidized agricultural research, and in addition they have Research Officers of their own engaged in the investigation of particular problems. A recent development has been the acquisition by the Council of an estate at Compton in Berkshire for use as a Field Station. Here problems such as those involved in certain diseases of animals will be investigated on a field scale when the necessary experiments in the laboratory and with small numbers of large animals have been done at the Research Institutes. The Institutes will also be able to obtain

* Obtainable on written application to the Secretary of the Council at 6A, Dean's Yard, Westminster, S.W.1.

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from the Station a supply of animals that have been raised in isolation and are free from disease.

In addition to advising on research in progress, the Council, through numerous technical or special Committees, on which they enlist the help of a large number of scientific workers not themselves members of the Council, plan and co-ordinate such immediate extensions of the research programme as seem necessary to secure a more intensive attack on problems of special urgency, especially in the field of animal and plant diseases.

A New Index Number of Agricultural Prices

At the monthly meeting of the Royal Statistical Society on Tuesday, January 18, 1938, Mr. C. T. Houghton, an Assistant Secretary of the Ministry of Agriculture and Fisheries, read a paper dealing with the changes that will be made in the Ministry's Index Number of Agricultural Prices in a new series that will be published shortly.

After describing the nature and history of the old series of index numbers, Mr. Houghton stated that owing to the changes that have taken place in home agriculture since the War, these index numbers have become to some extent defective. The most important change affecting index numbers was in the make-up of the agricultural output, in consequence of which the weighting used for calculating the general index for agricultural produce as a whole was no longer appropriate to present-day conditions.

To assist in dealing with the problem of revision the Minister of Agriculture and Fisheries appointed an *ad hoc* Advisory Committee, which was constituted as follows:—

Mr. C. T. Houghton (<i>Chairman</i>)	} Ministry of Agriculture and Fisheries.
Mr. F. Grant ..	..	..
Mr. E. F. Nash ..	..	..
Mr. J. M. Ramsay	} Department of Agriculture for Scotland.
Mr. D. A. E. Harkness ..	..	..
Mr. H. Leak	} Ministry of Agriculture for Northern Ireland.
Mr. J. H. Wain ..	..	..
Miss C. G. Gatey	} Board of Trade.
Mr. W. Holmes ..	..	..
Mr. T. H. Hodgson	} National Farmers' Union.
			} National Union of Agricultural Workers.
			} Agricultural Workers' Section of the Transport and General Workers' Union.

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Prof. A. W. Ashby	{ Department of Agricultural Economics, University College of Wales.
Prof. A. L. Bowley	..	..	{ Emeritus Professor of Statistics, University of London.
Mr. R. H. Mares (<i>Secretary</i>)	..	..	Ministry of Agriculture and Fisheries.

The Committee had presented unanimous recommendations which the Department had adopted.

In view of the purpose of the agricultural index number, which is to measure the influence of price changes on the value of the agricultural output, the arithmetical average would continue to be used. The base period of the new series would be changed from 1911-13 to 1927-29, the latter period being the most stable period of agricultural prices since the War.

The principal factor that had led to the need for revision was the weighting of the general index number. The weighting of the old series was based on the agricultural output of 1908. In consequence of the changes in the agricultural output since that date the old index now gave an excessive weight to farm crops and livestock and an insufficient weight to dairy products, poultry, eggs and vegetables; sugar beet and glass-house produce were not represented at all. For comparisons of price movements in the relatively recent past the use of weights based on the pre-War agricultural output was clearly inappropriate. If, however, there were adopted a new system of weights, based on a fixed collection of goods representing present-day output, and the actual output of the agricultural industry continued to change, the weighting, although satisfactory for the present time, would become less and less representative of contemporary output as time went on, and the problem of revision would again present itself, involving a further break in the series. Such periodical revisions and breaking of series were undesirable. A system of moving weights had, therefore, been adopted, under which the weighting would be changed annually so as to correspond with the average output of the previous five years. The object of adopting the five-year average was to eliminate the influence of changes due to weather conditions. When this had been done the changes in the output from year to year were comparatively small; consequently the new system would enable short-period comparisons to be made with accuracy; it would, at the same time, provide as correct a method as possible for making any comparisons in the series over a long period. It was hoped, therefore, that the new series could be continued

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indefinitely unless radical changes in the make-up of the agricultural output took place.

In future, two series of monthly index numbers would be published, one showing the actual changes in prices from month to month, and the other showing such changes corrected for seasonal variation. In the old series of monthly index numbers a correction for seasonal variation had been made by comparing prices each month with the price in the corresponding month of the base period. Experience had shown that this system was in some respects defective. Under the new system the index numbers showing actual price changes of certain commodities would be corrected for seasonal variation by the application of an index of seasonal variation, based in respect of each commodity on ten-year moving averages of the actual monthly prices of that commodity; to keep these indices of seasonal variation up to date they would be calculated annually on the basis of the latest ten-year period.

Varieties of Cereals for Spring Sowing

The following note has been communicated by the National Institute of Agricultural Botany:—

Seed time is with us and the National Institute of Agricultural Botany wishes once again to urge upon farmers the necessity for growing the right variety of crop, both from his own point of view and in the national interest. As far as cereals are concerned the Institute has been conducting field trials for many years and knows that the differences in yield of grain between good and poor varieties may easily be 20 per cent., while characteristics like the standing power of the straw may make or mar the harvest. Recommendations made on the results of these trials are issued from time to time in leaflet form and can be obtained free of charge through all Agricultural Organizers or direct from the N.I.A.B. The brief summary given below should be a guide for this season's spring sowings.

While not encouraging the growing of spring wheat, since it is seldom a profitable crop, the Institute's experience shows that if spring wheat is grown, the most satisfactory varieties are Little Joss if drilled by the middle of February, Red Marvel or A.1 for the first half of March, and thereafter until the middle of April, April Bearded.

The improvement of varieties in recent years has been particularly marked among spring oats, and many farmers could

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profitably change the variety of oats they grow. The Institute recommends Eagle, Star, Onward, Victory, Golden Rain and Golden Rain II, the last two essentially for home consumption, as the small size of their grain and its yellow colour frequently reduce the selling value. Marvellous is recommended for early sowing on good soils, as is Resistance, which though primarily a winter variety also produces high yields when sown early in spring.

In barleys the Institute restricts its recommendations to the well-known varieties Plumage Archer and Spratt Archer. The "1935" Plumage Archer has given better results than the "1924." Where late sowing cannot be avoided Svalof Victory or the Danish Kenia and Maja deserve trial.

Whichever variety is chosen, early sowing almost always pays. English-grown seed gives just as good results as imported seed, if the standard of purity and germination is the same. A further leaflet dealing in general terms with choice of seed, in which such points as purity, germination, variety, origin and price are dealt with, has been compiled by the Institute, and those who obtain it (gratis) either from County Organizers or direct from the Institute should find it of considerable use when deciding what seed to buy.

Acreage of Winter Wheat

From the returns received by the Ministry in December, 1937, from two-thirds of the occupiers of agricultural holdings of over 1 acre, it is estimated that the total acreage of winter wheat sown, or to be sown, in England and Wales is 1,807,000 acres.

This area is approximately 75,000 acres more than the total wheat area in 1937, and allowing for the acreage yet to be planted with spring wheat, it would appear that the total acreage devoted to wheat in 1938 will be at least 100,000 acres greater than the area last year. The estimated area of winter wheat alone is, in fact, greater than the total wheat area in England and Wales in any year since 1922.

The extension of the wheat acreage is very general throughout the country, the greatest increases over 1937 being recorded in the Eastern division (7 per cent.), the South-Eastern division (6 per cent.) and the North-Western division (13 per cent.). In the North-Eastern division the increase is only 2 per cent., but in this area the sowing of spring wheat is likely to be more common than in other districts.

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Grey Squirrels

Since the Grey Squirrels (Prohibition of Importation and Keeping) Order, 1937, came into force on July 31, 1937, as noted in the August, 1937, issue of this JOURNAL, the animal has had a good deal of publicity, and its status as an agricultural pest can now be said to be generally known. County Councils have been urged to take such steps as they can to bring prominently before persons in their areas, on whose land grey squirrels exist, the desirability of the extermination of the pest; to encourage measures of destruction; to conduct general propaganda against the animal; to deal effectively with the animal on lands, such as public parks, under their own control; and to urge other local authorities within County areas to take similar action. Suitable opportunities are also being taken by the Ministry to bring to the notice of large numbers of individual occupiers of holdings in England and Wales the wisdom of destroying the animal if it occurs, or should in future make its appearance, on their land.

Official propaganda has been ably supplemented by the National Anti-Grey Squirrel Campaign, a voluntary organization, the secretary of which is Mr. Laurance Swainson, Moorlands, Boxmoor, Herts.

The present time, when the cover of foliage is denied to the animal, is ideal for intensive measures, and it is hoped that the publicity that has been given to the subject in recent months will result in substantial diminution in its numbers during the present period of relative vulnerability.

It should be noted that the campaign is directed solely against the grey squirrel. Agriculturists have relatively little cause of complaint against the indigenous red squirrel.

The Grey Bulb Rot of Tulips and its Control

The following note has been communicated by Mr. W. Buddin of Reading University:—

In the April, 1937, issue of this JOURNAL, an article under the above title emphasized the importance of hygiene, and of the elimination of affected material as soon as this disease is noticed in a nursery. It was shown that reasonable control of the disease in forced bulbs could be obtained by planting the tulips with their "necks" projecting from the soil, and covering the boxes for the rooting period with some loose

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material, such as long straw. Experiments that were described showed that very fair control of the disease could be obtained by mixing a non-mercurial fungicidal powder, the effective constituent of which was believed to be a chloro-nitrobenzol preparation, with the surface soil in the boxes, immediately around the noses of the bulbs.

Mixing a powder with the soil to be placed round the necks of the planted bulbs necessitates a certain amount of forethought and labour, and involves the availability of boxing soil in reasonably dry condition. During this last forcing season experiments were therefore carried out to determine whether the same degree of control could be obtained by sprinkling an equivalent quantity of the chemical on top of the contaminated soil in the boxes after planting had been completed. Approximately 1 oz. of the powder was sprinkled over 10 sq. ft. of the surface of the soil, which just covered the noses of the bulbs (variety Wm. Copland) in the boxes. To obtain more even distribution, the chemical was mixed with an equal weight of dry talc. The bulbs and soil were watered as soon as the sprinkling was completed, and the boxes were then placed in the ash bed alongside bulbs planted in the same contaminated, but untreated, soil. Other boxes, in which the same quantity of powder was mixed with the surface soil as in previous years, were included for purposes of comparison. After about 9 weeks the whole batch was transferred to the glasshouse, and flowered early in January.

Two different lots of contaminated soil were used in the experiments; both had previously carried crops affected with the Grey Bulb Rot disease, but one lot was more heavily contaminated than the other. Bulbs planted in clean soil gave 100 per cent. of blooms, but 100 bulbs planted in the badly contaminated soil gave only 14 marketable flowers. As in previous seasons, a reasonable control of the disease was obtained when the powder was mixed with the surface soil; 50 bulbs in boxes so treated yielded 45 flowers, i.e., 90 per cent. On the other hand, merely sprinkling the chemical on the surface of the soil after planting gave quite unsatisfactory results, for only 61 marketable blooms were obtained from 150 bulbs so treated. The low percentage—40.5—of flowers indicates that this labour-saving method of treatment cannot be recommended.

The results were fully confirmed by those obtained when the less severely contaminated soil was used.

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Progress of the Land Fertility Scheme

The number of applications for contribution under the Land Fertility Scheme received from occupiers of agricultural land in the United Kingdom now exceeds 110,000. The quantities of lime and basic slag in respect of which these applications have been made are approximately 611,000 tons of lime and 330,000 tons of basic slag.

In the last issue of the JOURNAL reference was made to a memorandum (L.F.C.4) issued by the Land Fertility Committee explaining the procedure for giving approval to Associations that desire to make bulk purchases for redistribution to their members. Over 350 Associations have received their certificates.

In December, a memorial was presented by producers of lime substantially representative of the industry, praying that the prices approved for the purpose of the Scheme might be increased. Messrs. Peat, Marwick, Mitchell and Co. were appointed to carry out an investigation into the matters referred to in the memorial, and their report is under consideration.

Farmers who are experiencing difficulty in obtaining supplies of basic slag will be interested to know that inquiries made by the Land Fertility Committee show that the quantity of slag delivered since the date on which the Scheme came into operation is considerably in excess of deliveries during the whole of the preceding year, and that the estimated quantity that will be available for deliveries under the Scheme in the current fertilizer year ending on May 31, 1938, is 478,000 tons, i.e., double the deliveries in the previous year. It is anticipated that additional supplies that will materially ease the situation will become available in the next fertilizer year.

The same comparison is not possible regarding lime supplies, but there is no doubt that these have considerably increased.

LAND DRAINAGE: AN ACCOUNT OF IMPROVEMENT WORKS IN PROGRESS AND COMPLETED IN THE RIVER NENE CATCHMENT AREA

The River Nene Catchment Board was constituted as the result of the Land Drainage Act, 1930, on March 9, 1931. Before that date the control of the River Nene was vested in six authorities, and whilst one authority controlled the banks and another was responsible for the maintenance of the channel of the river, none of them had sufficient revenue for the proper maintenance of works.

The catchment area of the Nene is approximately 920 square miles, of which a little over 600 square miles are above Peterborough, which was until recently the limit of tidal influence. The remainder of the area is fen land, below the level of high water at ordinary spring tides, from which it is protected by embankments. The Catchment Board's liabilities include 170 miles of "main" river, 34 locks and 10 staunches, besides sluices and other controls. As the old authorities had only very limited funds available for maintenance, the channels had gradually become almost impassable and the locks and controls were in disrepair, in many instances very little short of derelict. These conditions, in addition to the number of mills on the river, most of which still function, complicated the discharge of water, especially in time of flood.

In order to have full information of the condition of the river, the Catchment Board promptly had a survey made, and upon this was based a comprehensive scheme of improvement—including strengthening of banks, reconstruction of locks, sluices, weirs, bridges and resectioning of channels. The estimated cost of this scheme is £748,000, towards which the Ministry is contributing a 55 per cent. grant under Section 55 of the Land Drainage Act, 1930.

From the sections taken during the survey it was evident that the river from the sea up to about $3\frac{1}{2}$ miles below Wisbech was in satisfactory condition, but that could not be said of the rest of the river.

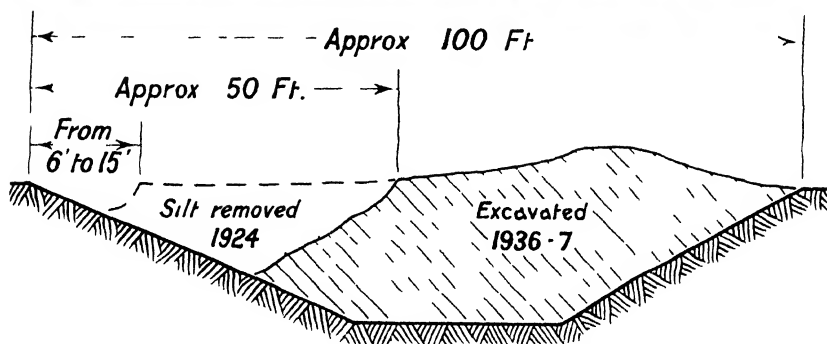
LAND DRAINAGE—R. NENE CATCHMENT AREA

Works below Wisbech. The $3\frac{1}{2}$ miles of river below Wisbech were shoaled up, giving a quite inadequate sectional area. This part has been dealt with by dredging in the centre of the river a channel 60 feet wide, to the required grade, keeping well away from the toe of the banks in order to limit the risk of causing slips. The dredging was carried out by a bucket dredger, the excavated material being deposited into barges, which were emptied by a suction dredger pumping the material ashore to a spoil depot in an enclosed site on the adjoining marshes. This part of the scheme, which was carried out by contract and involved approximately 96,000 cubic yards of excavation, has been completed.

Improvement Works, Wisbech. From above Wisbech Bridge up to Bevis Hall, the river for a length of two miles has a marked deficiency in sectional area as well as a high bed level. This naturally causes a holding up of the discharge of flood water, and an increase of velocity that endangers the banks. These banks have been maintained over a long period by the deposit upon them of stone that gradually sank into the silty bed of the river. From time to time, as this occurred, further stone was placed on the banks; this has had the effect of causing slips and of forming extensive shoals of stone. (See Fig. 1.) Borings that have been taken along the banks reveal that throughout this length there is a bed of sand and silt, in places 40 feet in depth, the top generally being about the level of low water at ordinary spring tides. The difficulties of this situation can be appreciated when it is realized that on the top of both banks there are narrow roads that must be kept open for heavy traffic. The problem is further complicated by the presence of buildings with frontages very near to the edge of these roads, affording little working space for plant. After much consideration it was decided to improve this length by supporting the banks by piling and afterwards dredging the channel to the required section. In 1937 a contract was entered into for two experimental lengths of 100 yards of river to be piled by different methods. In view of the fact that sand and silt were known to be present below the level of low water, it was necessary to provide for sheet piling to be used throughout.

For the first 100 yards length, a short distance above Wisbech Bridge, the proximity of houses along the roads on





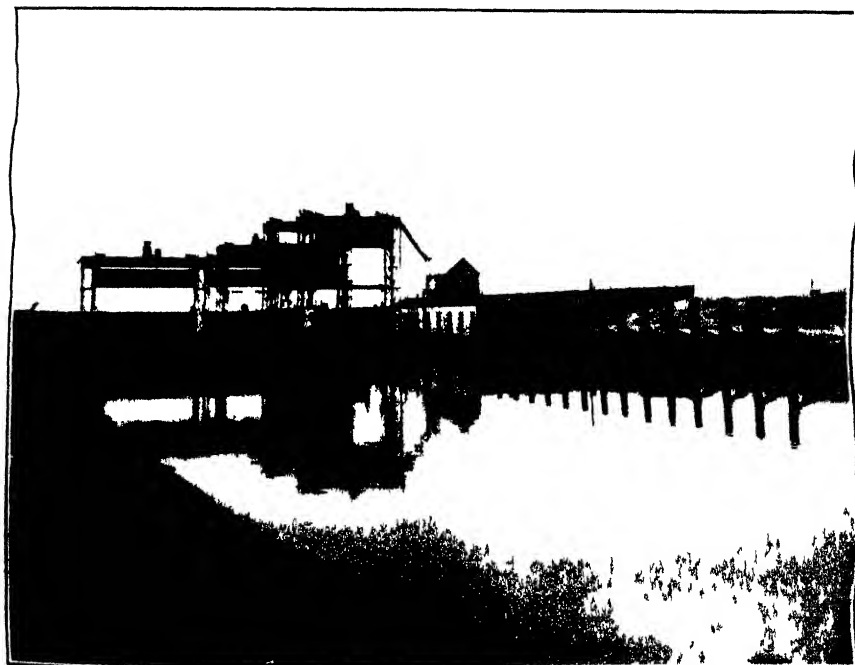
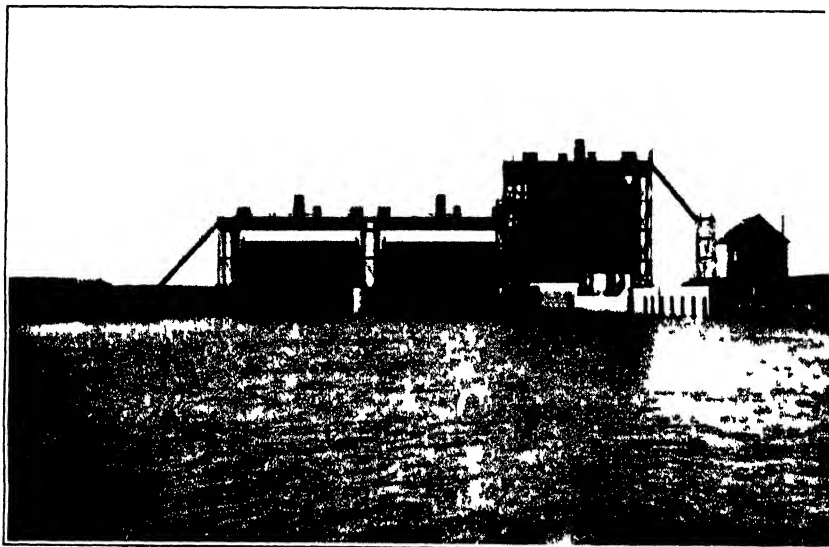


FIG. 3 (I p) Dog in a Doublet Sluice in Lock flood conditions
(I ft m) The same normal conditions

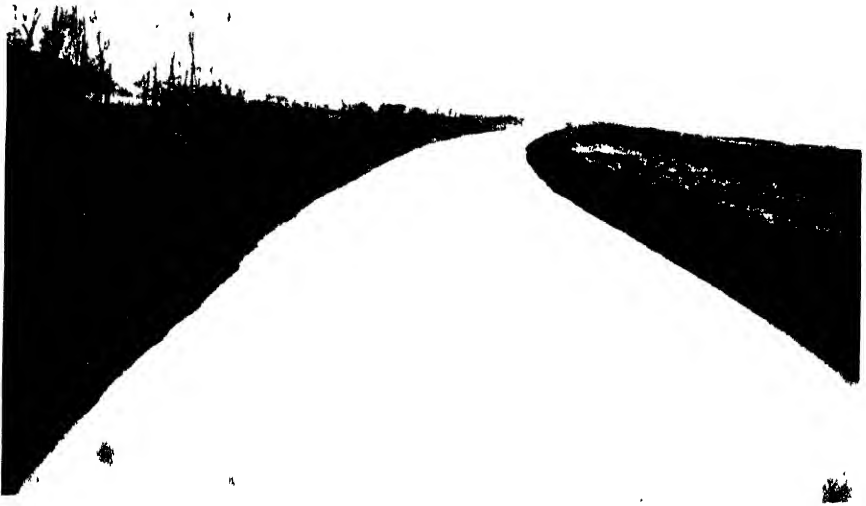
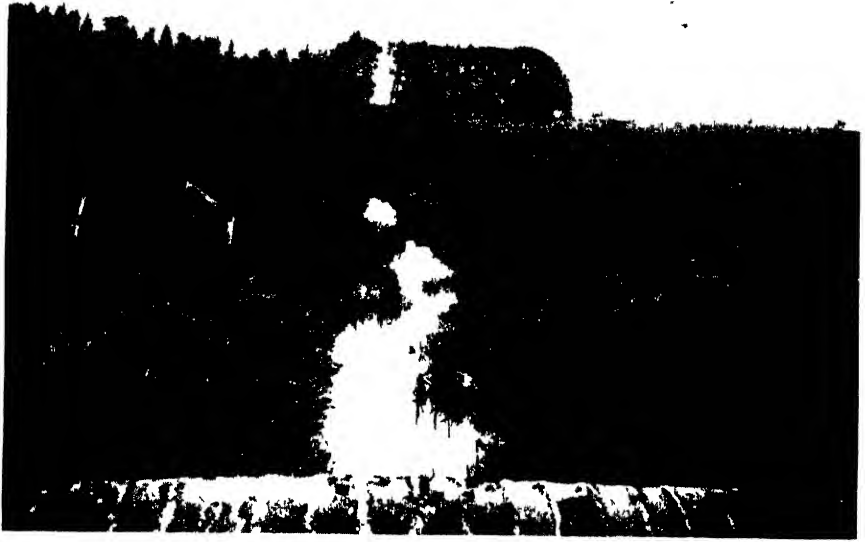


FIG. 4 —Flood Relief Works, Northampton (Top) Site of new flood channel before excavation (Bottom) Excavation completed.

The Ministry is indebted to the River Nene Catchment Board for the use of the photographs printed in this inset.

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top of the banks makes it difficult to use ties. This was overcome by the use of reinforced concrete sheeting piles, secured by king piles of the same construction, both being tied by a reinforced concrete capping beam, the whole in section taking the form of an inverted "V." The piles were cast with jetting tubes incorporated and were driven with a water jet to reduce vibration on adjacent buildings.

The second experimental length was started on the north side of the river, about two-thirds of a mile above Wisbech Bridge, outside the built-up area of the town. Steel sheet piling was used, and tied back with steel tie rods to a continuous reinforced concrete anchor wall. In the light of the experience obtained, it was resolved to carry out the whole of the work on the lines of the first 100 yards length in reinforced concrete. It is intended to re-use the existing stone, when dredged from the bed of the river, as pitching on the banks above the capping beam, and as far as possible to maintain the present amenities. The magnitude of the works contemplated on this comparatively short length of river can best be judged from the amount of the contract, which is £256,656.

Improvement Works, Bevis Hall to Peterborough. The river from Bevis Hall up to Peterborough Bridge is $16\frac{1}{2}$ miles in length, and here again the sectional area was shown to be obviously insufficient to carry the quantity of water coming down in a minor flood. When the Catchment Board realized this state of affairs they, with very commendable enterprise, immediately made arrangements for improving the cross-sectional area of this length, although grants under Section 55 of the Land Drainage Act, 1930, were not available at the time. A contract was settled and work was started in September, 1933, and continued up to April, 1935, when the present scheme was approved, by which time $3\frac{1}{2}$ miles of the river had been completely re-sectioned to Guyhirne Railway Bridge. The North Level Barrier Bank is situated very close to the north edge of the channel and has in many places little or no berm. It is being strengthened at the river edge by the placing of a rubble toe and reforming the side with faggoting to line up the channel where necessary.

As particular care had to be taken not to endanger this bank, all work to widen and deepen the channel had to be undertaken on the south side. Starting under the scheme at

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Guyhirne Railway Bridge, the initial part of the widening was carried out by means of dragline excavators working from the south bank and depositing spoil on the Washes. The main part of the excavation was taken out by a bucket dredger, and the excavated material was pumped to spoil depots as described previously. Between Guyhirne and Dog-in-a-Doublet Bridge depots were made close behind and parallel to the North Level Barrier Bank, and some 400,000 cubic yards of material were pumped into positions to be readily available to strengthen the bank. The whole of this improvement up to Peterborough Bridge is now completed. A diagrammatic comparison of sections taken at different periods is given in Fig. 2 (*centre*). The earlier sections were illustrated in the October, 1924, issue of this JOURNAL, after the first use was made of dragline dredgers on large river improvements for land drainage purposes.

A very serious obstacle to the improvement of this same length of river was the Northey Gravels, a high bar of hard gravel that extends along nearly half a mile of the bed, approximately two miles below Peterborough. A perpetual injunction was obtained in 1865, which prohibited the removal of this bar, it being held that its retention was necessary to preserve the fresh water supply for Thorney, the intake for which is at Dog-in-a-Doublet, some three miles below. In order to give the river the full capacity for which the scheme provides, it was essential that the Northey Gravels should be removed, but of course provision had to be made to maintain the Thorney water supply. This has been effected by the erection of a set of sluices with a lock, a short distance above Dog-in-a-Doublet Bridge, with a re-arranged intake for the water supply. The structure is built of reinforced concrete on a foundation base of concrete, varying from 9 feet thick at the upstream end to 6 feet at the downstream cill, with reinforcing bars in the bottom and top lifts of concrete. Two steel sluice gates, each 30 feet wide, are placed on the south side, separated by a pier 7 feet wide.

The lock is on the north side, the main pen being 145 feet long and 26 feet wide; it is arranged to accommodate craft up to 133 feet long with a beam of 22 feet and a laden draught of 9 feet. In order to lessen the waste of water, the pen has been divided by a third gate for passing smaller vessels through a pen 88 feet in length. The three lock gates are all of the steel vertical lifting type with 15 feet head room when fully

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raised and are designed to resist pressure from either side, for, in addition to an estimated tidal difference in height of 13 feet when all the improvement works are completed downstream, it is possible in times of drought for the upstream level to be reduced below high tide levels. As in the latter event the head is reversed, provision is made for filling the lock from upstream or downstream. The use of vertical gates also enable the lock to be used as an additional sluice. The sluice and lock gates are each operated by 8-h.p. electric motors, which enable them to be raised or lowered at a speed of 8 feet per minute; they can be brought into action from the control cabin placed near the lock or from the superstructure of each gate, where manual operating gear is also provided.

The concrete dished apron is 80 feet long, beyond which protection is extended a further 25 feet by the laying of fascine brushwood mattresses. The toe of the south bank is also protected against scour by mattresses for a length of 110 feet, and another mattress 40 feet wide was placed across the channel immediately above the sluices. These mattresses were sunk into position by weighting with granite blocks distributed at about $\frac{1}{2}$ ton per square yard.

The intake for the Thorney water supply is taken through the upstream wing wall of the lock to the Thorney river through a length of 400 yards of duplicate 18-inch cast iron pipes. In case water levels are considerably lowered in time of drought, arrangements can be made to pump water through one of the pipes. The set of sluices, etc., took two years to erect under very difficult conditions and cost approximately £43,000; the opening ceremony took place in July, 1937, and was performed by Sir Donald Fergusson, K.C.B., Permanent Secretary of the Ministry of Agriculture and Fisheries in the unavoidable absence of the Minister. See Fig. 3.

The existing road bridge at Dog-in-a-Doublet immediately below the sluices was found to be an obstruction, both as to height as well as line of river, and it has now been reconstructed.

Whittlesey Washes Improvement Works. The Whittlesey wash lands have an area of 3,500 acres and extend from Guyhirne to Stanground on the outskirts of Peterborough. The wash acts as a reservoir for flood waters when adverse

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tides restrict the discharge into the tidal portion of the river below Dog-in-a-Douplet sluices. Before any of the Catchment Board's improvement works had been carried out in the river channel, the washes would flood very easily, a condition that is not desirable, since it is obvious that a reservoir of this nature should be kept empty until its use becomes absolutely necessary. The capacity of the channel from Bevis Hall to Peterborough has been so greatly increased that it now carries all normal floods. At Northey Gravels a weir 178 feet long has been constructed in reinforced concrete, and is capable of adjustment as to height to pass flood water on to the wash at a predetermined level. The old inlet sluice at Stanground, which was once in poor condition, had a gate 9 ft. 4 in. in width, and to replace this a new structure in reinforced concrete has been erected with a steel central lifting gate 15 ft. in width to open the full depth, with side gates both 20 ft. wide, one opening 4 ft., the other 3ft., from the top of the sluice. This will permit of a greater control of flood water in conjunction with the weir at Northey Gravels. The outfall for flood water from the wash is through Guyhirne sluice, the structure of which was in bad condition. A new sluice has been built, the opportunity being taken to increase the width of the gate from 9 ft. to 15 ft., thus ensuring a more rapid discharge when river conditions permit. The new sluice is in reinforced concrete with steel pointing gates on the tidal side and a steel gate of vertical lifting type on the upstream side.

It is interesting to note here that in the extremely wet winter of 1936-37, the improved channel below Peterborough was able to discharge all flood water without utilizing the wash until March 14, 1937. On that day there was an adverse combination of heavy flood with an unusually high spring tide backed by a strong north wind, which it was reported gave the highest water level at Wisbech for 30 years. The water then flowed on to the wash, but did not reach a high level, owing to the fact that the wash was empty until the emergency for which it was needed.

Improvement Works from Peterborough to Northampton. Above Peterborough the river winds its 66-mile way down from Northampton through a narrow valley with very quick "run off," making it subject to sudden rises in level after even local rain; it is divided into levels by 44 locks and

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staunches with a total fall of 160 ft. The condition of the channel itself, apart from the controls, was deplorable, being overgrown with trees and obstructed with fallen timber, shoals, and weed growth, making it impossible for even the Board's own small craft to move on the river. The scheme provides for the forming of an adequate width of channel with a normal depth of 6 ft. of water. From Peterborough Bridge to Woodston Stauch, in a length of about half a mile, the river is crossed by no fewer than six railway and road bridges, there being little room on the bank for deposit of dredgings; a contract has been let for this to be dredged in the same manner as below Peterborough, the spoil being moved to a convenient depot.

Above Woodston Stauch the improvement to the channel is being carried out by administration, with the use of dragline excavators and floating grab dredgers. Pontoons are provided for use in conjunction with the dragline excavators to facilitate crossing the river when necessary, while they may be converted into floating dredgers when fitted with grab instead of dragline bucket. Dredging operations are in progress in different parts of the river, and started in each place as follows:—Above Woodston Stauch, above Wansford Lock, above Warmington Lock, above Barnwell Stauch, above Wellingborough Lock and above Northampton Lock. Altogether a length of about 26 miles of river channel improvement has been completed and four new cuts made on the river Nene. The one large tributary of the river Nene is the river Ise, which joins it at Wellingborough and is the cause of much local flooding; great improvement has resulted from the resectioning and regrading of the lower $3\frac{1}{2}$ miles, on which 21 new cuts have been made.

In dealing with the reconstruction of the controls on this length of river, it was necessary to take into consideration the conservation of water in time of drought as well as the discharge of flood water. In this connexion, many of the existing staunches will have to be replaced by locks, but it has been found possible to eliminate some by lowering the downstream cill of the next upstream lock. This will have the effect of more efficiently draining the adjoining land, as the normal water level between the site of the stauch and the lock above will be much lower. The old locks were in poor condition generally, some indeed in a grave state of dilapidation, and the dimensions did not conform to any

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standard. Twenty-one locks have now been reconstructed to the same measurements for the lock pen as those recently built on the Grand Union Canal, i.e., 83 ft. 6 in. long, 15 ft. wide, with 6 ft. of water over the cills. These locks will now accommodate one standard 100-ton craft or two narrow canal barges side by side, with little waste of water, an important factor in time of drought. The construction of these locks is in mass concrete with a facing of blue brick to withstand the wear in the lock pen. The upper gates are of the mitre timber type, and those at the lower end are of the vertical steel lifting type. This combination of mitre and lifting gates was adopted so that the locks could be used as sluices to full capacity in time of flood.

In view of the relatively high level at which the river has to be maintained, owing to the existing mill rights, it is essential to provide additional means for the rapid discharge of water during flood periods and at the same time keep up the water to the correct level for the operation of the mills. In order to effect this, tilting or lifting gates varying from 2 to 3 ft. in depth have been or are to be installed on weirs where found to be necessary. The weir crest is first cut down by the depth of the gate and a gate fixed with the top at the same level as the original weir crest. By lowering the gate in time of flood the water level upstream can be maintained and an increased discharge is obtained.

The Catchment Board has very wisely adopted the policy of acquiring the water rights at mills wherever possible, when opportunity occurs. Having obtained full control of the water where this has been done, it is possible further to regulate the flow both in drought and flood periods. At present the Catchment Board have either acquired or are negotiating for these rights at seven mills on the river.

In the vicinity of Northampton much flooding was experienced, owing to some extent to building operations and the general raising of the level of the areas that were apt to flood. A flood relief scheme was designed, and here again the Catchment Board undertook, with the assistance of the Northampton Corporation, to proceed with its execution before grants became available. The works then carried out included the making of a new channel for flood relief, this taking flood water when required through two tilting gates, 16 ft. wide and 2ft. 6 in. deep, electrically operated by remote control from a station about half a mile distant. A new

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sluice has been constructed at Nunn Mills, and work is in progress on deepening the channel below Northampton Bridge, this channel taking the full flow of the river from above the town, where other relief works are contemplated under the Scheme (see Fig. 4).

In order to cope with the maintenance of plant, etc., under the scheme, the Catchment Board has had to increase the capacity of the workshops at its main depot at Oundle. Incidentally, the mitre timber gates for the locks are entirely made at this depot, it being found cheaper to make them there than to have them made elsewhere; and it is pleasing to record that the workmanship displayed on them reaches an extremely high standard. There is equipment in the fitters', carpenters', and blacksmiths' shops for the repair and conditioning of the dredgers, barges, and other plant in use on the scheme.

The Catchment Board have also two other grant-aided schemes in progress, one for the reconstruction of the South Holland Sluice, and one for the provision of pumping plants to supplement the discharge of water from the extensive North Level area, when gravitational flow is retarded. Thus the whole of the drainage improvement of this Catchment Area is being undertaken, and its completion will confer direct benefit upon some 196,000 acres of low-lying land.

REPORT OF THE POULTRY TECHNICAL COMMITTEE OF GREAT BRITAIN

The Report of the Poultry Technical Committee* for Great Britain was published on February 8. The Committee was appointed in September, 1935, by the Secretary of State for Scotland and the Minister of Agriculture, with the following terms of reference:

To consider the present methods of supply and distribution of hatching-eggs, day-old chicks, and breeding stock in Great Britain, both generally and with particular reference to the reduction of poultry mortality; and to make recommendations for the improvement of those methods.

In the course of the investigations by the Committee the conditions of the industry were studied in many poultry areas of the country, but it was soon found that it was unnecessary to extend these investigations, "for the position in every area was similar; the burden of the story told us was always the same—one of an industry not only hard hit by economic conditions, but struggling under an almost impossible handicap of diseased or weakly stock."

It was decided that further visiting was not only superfluous but definitely to be deprecated, "for the state of the industry can only be described as one of emergency, and it would be a disservice to delay bringing this indubitable fact to the notice of our appointing Ministers. The urgency, in fact, is such that we have hastened the submission of our recommendations, knowing that in some matters of detail our report may be regarded as incomplete, but convinced that the expediting of our main suggestions is sufficiently important to outweigh that demerit."

The Mortality Position. A chapter under this title in the Report reveals that deaths at egg-laying trials rose from 6.6 per cent. in 1926-27 to 17.7 per cent. in 1936-37. This increased mortality is reflected throughout the poultry flocks of the country, a fact borne out by the results of surveys of poultry farms made by agricultural economists in several areas. In Wales, for example, a survey of 49 farms showed that in 1936-37 the original number of hens in the laying flocks was reduced by 55 per cent. by deaths and removals. The financial losses involved were considerable, and added three-pence to the cost of producing one dozen eggs. A similar picture is provided in Yorkshire, where a depletion of over 60 per cent. was recorded in a survey of 26 farms.

* Published by His Majesty's Stationery Office. Price 1s. (by post 1s. 2d.).

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The Committee found in all the areas visited, and from particulars supplied from other areas, that instances akin to these quoted were occurring with lamentable frequency; and they express their anxiety that the appointing Ministers should bear in mind the tragedy confronting the poultry-keeper of limited capital, faced with such losses. In their opinion it is essential that steps should be taken without delay in an effort to protect the industry from disasters of this magnitude.

Causes of Increased Mortality. The Committee state that this position is associated with the unprecedented demand for stock, hatching-eggs, and day-old chicks in post-war years arising from the too rapid expansion of the poultry population, under the stimulus of high egg prices. Stock of low vitality and stamina, due to unsuitable breeding methods adopted in an effort to meet this demand, has permeated the industry. The expansion has also led to overcrowding, with its attendant ill effects; to bad methods of husbandry, particularly on the part of "new comers" with insufficient knowledge and poultry experience; and to specialization in many directions, especially in the hatching of day-old chicks for supplying to the commercial egg producer. The position has been aggravated by the extent to which the poultry keeper has come to rely on Press advertisements as a guide to the purchase of stock of all descriptions; and further by the increased use of auction markets, subject to inadequate control, as a medium for the purchase of day-old chicks, hatching eggs, and even breeding stock.

The rise in the scope and importance of the industry has not been accompanied by an increase in scientific research on a scale at all commensurate with the requirements. Particularly is this true of research into mortality, the provision for which has been, and is, gravely inadequate. As an indication of this, it is stated that by far the heaviest mortality losses now being experienced by poultry keepers are due to a group of ailments the cause of which is unknown, and for which no curative or control measures can be advised.

Recommendations. Drastic and urgent measures to cope with the present position are recommended. The distribution of diseased or debilitated stock of all descriptions must be stopped. Steps must be taken to secure an all-round improvement in the quality of breeding stock. Efforts must be made to build up foundation stock of guaranteed history, particularly from the standpoints of health and stamina, for introducing into the pedigree breeding flocks of the country. The opera-

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tions of hatcheries, of dealers, and of auction sales must be controlled. Unscrupulous advertising must be checked. Simultaneously, research into the causes of mortality must be prosecuted on a much greater scale, and educational facilities must be extended to secure the more general adoption of sound methods of husbandry.

To secure these objectives requires the establishment of an independent organization, with statutory powers, and so constituted as to ensure that the various sections of the industry affected are not only consulted in the formulation of schemes, but are closely concerned in the administrative functions involved in carrying the schemes into effect.

These measures will involve statutory control, and financial assistance from the State on a fairly substantial scale. The Committee are satisfied that the industry cannot, by its own efforts and within any reasonable period of time, bring about the radical improvement that is needed. They are equally satisfied that in existing economic conditions the majority of breeders cannot afford to adopt the highest standards of husbandry and breeding.

In the Committee's judgment, a compulsory control system to be successful must be simple to operate, and must have as its objective, not an unwarranted interference with the methods of competent breeders, but the elimination—as distributors—of those who, whether wilfully or in ignorance, are distributing stock in any form which no competent poultry keeper would regard as worthy to replenish an industry dependent for its continued existence on a high standard of health and stamina. The Committee believe that commercial egg producers would unanimously support their view that they are entitled to claim protection from the distribution of inferior or diseased stock; and only by statutory control can this protection be afforded them.

It is recommended, therefore, that statutory control of distributing centres* be instituted forthwith; and that all such centres (subject to such exemption, by reason of small numbers of birds or otherwise, as the Controlling Authority might allow) be required to register; and that the Controlling Authority be

* By "distributing centres" is understood centres from which stock, hatching-eggs or day-old chicks are distributed. By "stock" is meant all live chickens, pullets, hens, cockerels and cocks not sold for immediate slaughter. Ducks and other domestic poultry might be included later at the discretion of the controlling authority as and when found desirable and practicable.

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given powers, *inter alia*, to suspend or revoke the registration of any distributor, on grounds (a) of the existence of disease to an extent or of a nature rendering the continued distribution of stock, hatching-eggs or day-old chicks from that centre undesirable; or (b) of the obvious unsuitability of the stock for breeding purposes; or (c) of manifestly unhygienic conditions. Dealers, i.e., persons buying stock, hatching eggs or day-old chicks, for immediate resale, should also be required to register, and be required to have their registration suspended or revoked if found to be consciously responsible for the distribution of diseased or unsuitable stock. The Committee consider further that auction sales need to be brought under stricter control; this matter, they suggest, the Controlling Authority should be required to examine.

Superimposed on the system of compulsory registration, the Committee recommend that there be established a voluntary grading scheme, aiming at the production of higher quality stock, and that breeding centres approved under this scheme should receive free services in the form of veterinary and general inspection (including post-mortems and culling) and in addition a premium from State funds. The precise form and amount of this premium should, it is suggested, be recommended by the Controlling Authority; the Committee's provisional view is that a premium at the rate of 1s. per head of approved female breeding stock remaining at the end of the breeding season, in the case of "commercial" breeders, and 2s. per head in the case of "pedigree" breeders, should suffice, with the advertising value of official "approval" to persuade a gradually increasing number of poultry breeders to enter the scheme. The conditions of approval would be laid down by the Controlling Authority, and would be made more stringent as the scheme progressed. The Committee estimate that the total cost of premiums at the rates suggested might ultimately amount to £50,000 a year, and that as and when the economic position of the industry justified the course they might be progressively diminished, and eventually withdrawn.

It is considered that the primary aim of the grading scheme for "pedigree" breeders should be to secure that such detailed records were kept as would furnish a guide to the extent to which desirable qualities such as hatchability, rearability and livability were present in the progeny of individual birds and families. The Committee realize that the expression of these

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qualities may at times be cloaked or inhibited through unfavourable environmental conditions, which may be accidental in origin, such as an outbreak of some disease. It is felt, however, that more attention on the part of breeders to the keeping of such records will assist them in their aim of building up families of birds that can prove their capacity to live as well as to lay eggs, and to produce progeny which are easily reared, and which in turn demonstrate their ability to live for normal periods, and to give satisfactory production under normal conditions.

Hatcheries securing hatching eggs only from approved breeding farms would also be approved under the scheme, subject to regulations relating mainly to the hygienic condition of the hatchery premises. For some time this could only apply to a minority of the hatcheries. The Committee recommend, therefore, that in addition to the normal registration requirements for hatcheries, they should be required to fulfil certain conditions, to be imposed by the Controlling Authority, including the submission of satisfactory schemes for the culling of the breeding stock on their supplying farms and the blood-testing of such stock for B.W.D. with effective disposal of reactors.

The Controlling Authority should also be given powers to require, subject to the approval of the Secretary of State for Scotland and the Minister of Agriculture, the compulsory application of preventive measures in respect of any specified disease, if considered desirable in the interests of disease control. The Committee refer particularly, of course, to the blood-testing of stock for the control of bacillary white diarrhoea.

There remains the question of providing for the further building up of stock quality, and for this purpose the progeny-testing station is essential. Progeny-testing is a long and scientific business, which private breeders can only be expected to conduct on a limited and incomplete scale, but the Committee believe that much more comprehensive operations are necessary for the production of the highest-quality foundation stock, of known history and character. This, the Committee suggest, is a financial responsibility which should properly be assumed by the State, and they recommend that provision for it should be made in the system of control, and that the Controlling Authority should be charged with the duty of preparing a scheme. It is possible that an initial capital outlay of £25,000, and maintenance expenditure of £5,000 per

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annum, might be required, though these figures are conjectural.

The Poultry (Stock Improvement) Commission. The Committee are satisfied that any controlling organization must be such as to secure complete uniformity of administration throughout Great Britain, bearing in mind that the main problem is to prevent the distribution of debilitated and diseased stock in an industry in which stock is transported frequently and for long distances and often from one country to the other. An equally important requisite is that the organization should command the goodwill and confidence of the industry.

They recommend the establishment of a Poultry (Stock Improvement) Commission for Great Britain, to be appointed by the Secretary of State for Scotland and the Minister of Agriculture and Fisheries, with Advisory Councils for England and Wales, and for Scotland, appointed by the respective Ministers, and with a Standing Executive, also appointed by the two Ministers, consisting of the Vice-Chairman of the Commission, the Chairman of the two Advisory Councils, and two other members, to which would be referred the numerous difficult problems arising in the course of administering the policy of the Commission.

The suggested composition of the Commission is set out in full detail in Chapter V of the Report, which also reviews the procedure that the Committee considers should be followed. This is succeeded by a chapter that deals with the control scheme in operation as visualized by the Committee.

Cost. The total annual cost of the proposals for control is tentatively estimated at something of the order of £110,000. This figure, it is stated, should be considered in relation to the annual value of the output of the home poultry industry, which may be estimated at £30,000,000; to the loss from disease, estimated by the National Veterinary Medical Association to be over £4,000,000 per annum for adult laying-birds in England and Wales alone; and to the Committee's considered opinion, that the incidence of mortality is one of the most vital factors affecting the prosperity of the industry.

Review of the Principal Diseases of Poultry. The Report concludes with a valuable Appendix containing the latest available technical information regarding the symptoms, methods of dissemination, incidence, methods of detection, and suggested treatment of the main diseases of poultry.

AGRICULTURE ACT, 1937: PART IV (DISEASES OF ANIMALS)

In the December, 1937, issue of this JOURNAL (pp. 828-830) a note on this subject included the text of a circular letter addressed by the Ministry on November 12, 1937, to local authorities concerned in the application of Part IV of the Agriculture Act, 1937. That letter dealt mainly with the field organization of the State Veterinary Service, the procedure in regard to the transfer of functions under the Act in so far as staff arrangements are concerned, and the date (April 1, 1938) on which the Minister expected to be in a position to assume responsibility for the functions to be transferred. The Minister has now appointed the Superintending Inspectors who will be in charge of the 22 Areas into which the 78 Divisions in Great Britain have been grouped, and also the Divisional Inspectors to take charge of Divisions. A conference of Superintending Inspectors was held on February 9, which was addressed by the Minister and Sir Donald Fergusson, Permanent Secretary to the Ministry. The Minister referred to the importance of the occasion—the launching of a great national service—and expressed confidence in the future of the State Veterinary Service, which is being inaugurated with the goodwill of all concerned. Sir Donald, in welcoming the officers appointed from local authority service, referred to the great tradition of public service inherited and enhanced by Sir John Kelland and his colleagues.

The Minister's proposals in regard to the performance of veterinary duties under the Diseases of Animals Acts and under enactments relating to milk and dairies on and after the "appointed day" were communicated to local authorities in the following further circular letter addressed to them on February 8. It will be noted that while it is proposed to defer for a further short period the making of an Order under Section 34 (3) of the Agriculture Act, 1937, bringing Part IV of the Act into operation, arrangements for the transfer of functions are proceeding on the assumption that the "appointed day" will be April 1, 1938.

AGRICULTURE ACT, 1937, PART IV

February 8th, 1938.

CIRCULAR LETTER TO LOCAL AUTHORITIES CONCERNED IN THE APPLICATION OF PART IV (DISEASES OF ANIMALS) OF THE AGRICULTURE ACT, 1937

SIR,

1. I am directed by the Minister of Agriculture and Fisheries to refer to the Circular Letters addressed to local authorities on the 28th July and 12th November last on the subject of the transfer of veterinary functions under Section 19 of the Agriculture Act, 1937, and to say that the Superintending Inspectors to take charge of the 22 Areas into which the 78 Divisions in Great Britain will be grouped, have now been selected. A list of these officers, showing their present appointments and the areas and stations allotted to them, is contained in the Appendix. The Minister expects to be in a position at an early date to announce the names of officers selected for appointment as Divisional Inspectors.

2. It is hoped that, subject to the willingness of local authorities to lend to the Ministry the services of the officers concerned until the "appointed day" (under the arrangements proposed in the Ministry's Circular Letter of the 12th November), the Superintending Inspectors will all take up their stations on the 14th February and the Divisional Inspectors not later than the 28th February, so that they can proceed to make arrangements in their respective Areas and Divisions for the transfer of functions on the "appointed day," which it is contemplated will be the 1st April, 1938.

3. The Minister's proposals for the performance of veterinary duties under the Diseases of Animals Acts, 1894 to 1937, and under enactments relating to milk and dairies when Part IV of the Agriculture Act, 1937, comes into operation have recently been discussed with representatives of the County Councils Association, the Association of Municipal Corporations, the Association of County Councils in Scotland, the Convention of Royal Burghs and the Association of Councils of Cities in Scotland, who have expressed general approval of the proposals. These are set out in broad outline below. The Superintending Inspectors and Divisional Inspectors will have instructions to discuss with the appropriate officers of the local authorities in their Areas and Divisions the local application of the proposed arrangements and to explain any matters upon which further information may be desired.

TUBERCULOSIS ORDER

4. *Draft Order.* The Minister is advised that no Order to replace the existing Tuberculosis Order of 1925 can be made under the extended powers conferred by Section 22 of the Agriculture Act, 1937, until Part IV of that Act is actually in operation. It will therefore be necessary to defer the actual making of the Order until the "appointed day." A final draft of the Order, in the form in which it will then be issued, will, however, be circulated to local authorities at an early date in order that they may have due notice of its provisions. The Order will provide for the slaughter of affected animals, and for the payment of compensation therefor, by the Minister, and will follow generally the lines of the existing Order with the necessary consequential amendments. A separate circular letter will accompany the draft Order. It is proposed to make the following arrangements in regard to microscopical and biological examinations of samples of milk, etc., and the salvage of carcasses when the Order comes into operation.

5. *Microscopical Examinations.* It will be regarded as a general principle that veterinary inspectors should carry out their own microscopical examinations of milk, etc., for diagnostic purposes. Each Divisional Office will have a small laboratory attached to it for this

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purpose, and other arrangements will be made in the case of whole-time inspectors stationed at a distance from the Divisional Office.

6. *Biological Examinations.* At the present time biological examinations of samples of milk taken for diagnostic purposes under the Order of 1925, are carried out at a large number of laboratories throughout the country, and it would be impracticable and uneconomic for the Minister in organizing the service on a national basis to utilize all these laboratories. It would also be impracticable, in the short time available, to formulate and bring into operation any permanent arrangements for this work. In the circumstances it is proposed that Superintending Inspectors shall be instructed to review the existing arrangements in their Areas with a view to securing, as far as possible, that samples from each Division are sent to one laboratory only within the Division. Subject to this consideration, where samples are now sent to a local authority laboratory, consideration will be given to the continued use of such a laboratory, provided that suitable financial and other arrangements can be made with the local authority concerned. Any arrangements made, however, would be without prejudice to future consideration of policy in regard to this particular service.

7. *Salvage of Carcasses.* Wide differences exist in the practice of local authorities in regard to the salvage of carcasses of animals slaughtered under the present Order. In some cases, owing to special local circumstances, no salvage is attempted; in others, carcasses are salvaged either through knackers or butchers according to the condition of the live animal; while in others the local authorities concerned, for various reasons, do not select any animals for salvage through butchers. In some areas in Scotland it is the practice for the slaughter of affected animals to be carried out only at public abattoirs, salvage usually being arranged by an abattoir official or by the veterinary inspector. It appears to the Minister that it would be impracticable at this stage to establish a uniform system for the country as a whole and it is proposed for the present to continue, as far as practicable, the system at present in operation in each local authority area.

8. *Surplus Equipment.* Local authorities have already furnished information in regard to microscopes, centrifuges, etc., supplied for the use of their veterinary officers which will not be required by the local authority after the "appointed day." The Minister will be prepared to consider the purchase at a reasonable valuation of suitable surplus equipment, and this matter will be referred to Superintending and Divisional Inspectors in the first instance.

FUNCTIONS OF VETERINARY INSPECTORS UNDER THE MILK AND DAIRIES ACTS AND ORDERS AND OTHER ENACTMENTS RELATING TO MILK

9. *Routine Veterinary Inspection of dairy herds other than herds licensed for the production of "designated" milks.* (a) Careful consideration has been given to the policy to be pursued in regard to the frequency of routine inspection of dairy herds on a national basis. It is proposed to aim at a maximum of four inspections per annum in the case of flying herds (i.e. herds replenished by purchase of cattle in the open market) and two inspections per annum in that of self-contained herds (i.e. herds maintained by breeding within the herd). It will not be possible to attain this national maximum for some considerable time after the "appointed day," and it is, therefore, proposed at the outset to continue the existing practice of local authorities subject to a maximum of four inspections per annum in the case of flying herds and two per annum in that of self-contained herds. Where no regular inspection is carried out at present it is proposed to arrange at least one inspection per annum as soon as circumstances permit.

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(b) *Veterinary inspectors will be instructed that, where in the course of their inspection they find a milch cow in a pathological condition liable to infect or contaminate the milk, they should hand to the owner a copy of their report describing the animal and the condition found. A copy of the report will also be sent to the local authority, with whom will rest the responsibility for such action (if any) as they consider necessary, under the Milk and Dairies Acts and Orders. In the case of an animal coming within the scope of the Tuberculosis Order, or of any other Order under the Diseases of Animals Acts, the veterinary inspector would, of course, deal with the animal under that Order.

10. *Clinical Inspection and Tuberculin Testing of herds licensed for the production of "designated" milks.* It is proposed that the Ministry's veterinary inspectors shall carry out the prescribed veterinary examination and tuberculin testing of herds licensed under the Milk (Special Designations) Orders, including the post-addition tuberculin testing of added animals where required, but not pre-licence examinations and tests which will be the responsibility of the applicant for licence and will be carried out by private veterinary surgeons subject to the requirements of the Orders. Where, however, within the prescribed period before application for licence is made, a veterinary examination and/or tuberculin test of the herd has been made on behalf of the Minister by a veterinary inspector a certificate of such examination and/or test will be furnished for the purposes of the application. No fee will be charged, either to the local authority, or to the owner, for any veterinary examination or test carried out by a veterinary inspector under this paragraph. Arrangements will also be made for the local authority to be kept informed of the results of clinical inspections and tuberculin tests of licensed herds carried out by a veterinary inspector.

11. *Veterinary Inspection of Dairy Cattle under Section 4 of the Milk and Dairies (Consolidation) Act, 1915, and Section 4 of the Milk and Dairies (Scotland) Act, 1914.* Where a Medical Officer of Health (A) has reason to suspect that tuberculosis is caused, or is likely to be caused by the consumption of certain milk, and on ascertaining the source or sources of supply has given notice to the Medical Officer of Health (B) of the county or county borough (large burgh in Scotland) in which the cows from which the milk is obtained are kept, it is contemplated that Medical Officer of Health (B), having no longer a veterinary inspector at his disposal, will communicate the information received by him to the Ministry's Divisional Inspector. The latter would then arrange a veterinary inspection of the cattle in the dairy and proceed as if he had received notice of suspected disease under the Tuberculosis Order, informing Medical Officer of Health (B) of the result of the enquiry in due course. No charge will be made to the local authority in respect of the veterinary inspector's services, or in respect of the examination of any samples of milk that he may consider it necessary to take in connection with his inspection.

12. *Veterinary Inspection of Dairy Cattle in connexion with other disease in human beings.* Where in connexion with illness of human beings suspicion attaches to milk and the Medical Officer concerned desires the co-operation of a veterinary inspector in regard to the veterinary examination of cattle in the dairy supplying the milk, the Ministry's Divisional Inspector will, on request from the Medical Officer, arrange the necessary veterinary examination without charge. It is

* Where in this letter or in any memorandum issued by the Ministry the term "veterinary inspector" is used without qualification, it refers generally to the Ministry's whole-time and part-time veterinary inspectorate.

AGRICULTURE ACT, 1937, PART IV

contemplated that in cases of this kind the Medical Officer would normally accompany the veterinary inspector at the inspection.

13. *Inspection of Farm Buildings for the purposes of the Milk (Special Designations) Order, 1936.* (N.B.—This paragraph applies to England and Wales only.) In response to representations made by the County Councils Association, the Minister has agreed that where so desired by a local authority which for various reasons has utilized the services of its veterinary inspectors in connexion with the inspection of farm buildings for the purposes of the Milk (Special Designations) Order, 1936, he will be prepared to allow veterinary inspectors in the course of their routine inspections of dairy cattle to include the farm buildings in their inspection. It will be appreciated that the Minister has no power to take over from local authorities the function of inspection of farm buildings. The above arrangement is solely for the purpose of securing continuity in the areas concerned and cannot be extended to the areas of local authorities which have other arrangements in operation for the performance of such work.

14. *Collection of Milk Samples, etc.* The veterinary inspectors of certain local authorities collect and/or examine samples of milk for the purposes of the methylene blue reduction test under the Milk (Special Designations) Order, 1936, and undertake the marking of animals on behalf of owners. These duties will not be carried out by veterinary inspectors of the Ministry.

15. *General Co-operation with local Public Health Authority.* Where so desired the Ministry's veterinary inspectors will, as far as possible, continue existing arrangements for co-operation between veterinary inspectors and the local authority, e.g. by calling attention, informally, to any obvious breaches of the Milk and Dairies Acts and Orders found in the course of routine inspections. Any such arrangements would not, of course, in any way affect the obligations of the local authority under those Acts and Orders.

16. *Local Tuberculosis Schemes.* A few local authorities have introduced schemes for assisting producers, by the provision of free or assisted tuberculin testing of cattle and free advice, to eradicate tuberculosis from their herds. These schemes will, in effect, be replaced by the national scheme for the eradication of tuberculosis under the Agriculture Act, 1937, including the Tuberculin Test Survey which will reveal the self-contained herds that are comparatively free from tuberculosis. Those that contain less than about 10 per cent. reactors will qualify for financial assistance for further testing under the Attested Herds Schemes, in connection with which any necessary advice as to eradication measures would be given by the Ministry's veterinary inspectors. In the circumstances the Minister does not propose to continue the local schemes at present in operation.

VETERINARY INSPECTION OF ANIMALS AND POULTRY IN MARKETS

17. The present practice of local authorities in regard to the veterinary inspection of animals and poultry in markets varies so widely that it is proposed to postpone consideration of the general question of such inspection to a later date and meanwhile to give instructions to Divisional Inspectors to follow generally the existing practice in their Divisions pending such review.

FURTHER CIRCULAR LETTERS

18. In addition to the Circular Letter on the subject of the draft Tuberculosis Order referred to in paragraph 4 above, further Circular Letters will be addressed to local authorities as soon as possible dealing with (a) arrangements under Section 19 (3) and (4) of the Agriculture Act, 1937, for the services of veterinary inspectors to be made available in Scotland in connexion with meat inspection, and (b) amendments to the general Orders of the Minister under the Diseases of Animals Acts relating to notifiable diseases of animals (other than tuberculosis).

AGRICULTURE ACT, 1937, PART IV

THE APPOINTED DAY

19. It is proposed to defer for a further short period the making of an Order under Section 34 (3) of the Agriculture Act, 1937, bringing Part IV of the Act into operation, but arrangements for the transfer of functions are being proceeded with on the assumption that the "appointed day" will be the 1st April, 1938.

NOTE ON PART IV OF THE AGRICULTURE ACT, 1937

20. I am to take this opportunity to forward a reprint of a note on Part IV of the Act that appeared in the Ministry's JOURNAL for November, 1937. A limited supply of this reprint is available, and the Minister will be pleased to arrange for further copies to be supplied to local authorities on request.

I am, Sir,
Your obedient Servant,
(Signed) DONALD FERGUSON.

APPENDIX TO CIRCULAR LETTER T.A. 47694/C.L. DATED FEBRUARY 8, 1938

AGRICULTURE ACT, 1937

PART IV—DISEASES OF ANIMALS

AREAS AND STATIONS OF SUPERINTENDING INSPECTORS

(a) ENGLAND

Area No.	Comprising		Superintending Inspector (present appointment in brackets)	Station
	Divisions Nos.	Counties		
1	1	Northumberland	Mr H. B. Allan, M.R.C.V.S., D.V.S.M. (Chief Veterinary Officer, Durham (Co.))	Newcastle-on-Tyne
	2	Cumberland		
	3	Westmorland		
	4	Durham ..		
2	5	Yorks., N.R.	Mr J. O. Powley, M.R.C.V.S. (Superintending Inspector of Ministry)	Wakefield
	6	.. E.R.		
	7	.. W.R.		
3	8	Lancaster	Mr H. T. Matthews, B.V.Sc., F.R.C.V.S. (Chief Veterinary Officer, Liverpool)	Preston*
	9	Chester		
4	10	Derby	Capt H. L. Torrance, M.R.C.V.S., D.V.S.M. (Chief Veterinary Officer, Nottingham (Co.))	Nottingham
	11	Nottingham		
	12	Lincs. (Lindsey)		
	13	.. (Kesteven)		
	14	.. (Holland)		
5	15	Norfolk	Capt. J. D. Broome, M.R.C.V.S. (Superintending Inspector of Ministry)	Cambridge
	16	Suffolk (East)		
	17	.. (West)		
	18	Isle of Ely		
	19	Cambridge		
6	20	{ Rutland	Capt. W. L. Sheffield, M.R.C.V.S. (Divisional Inspector of Ministry)	Leicester
		{ Peterborough		
		{ Huntingdon		
	21	Leicester		
	22	Northampton		
	23	Warwick		

Subsequently changed to Chester.

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Area No.	Comprising		Superintending Inspector (present appointment in brackets)	Station
	Divisions Nos.	Counties		
7	24 25 26 27	Stafford Salop Hereford Worcester	Mr. A. B. Fewings, M.R.C.V.S. (Superintending Inspector of Ministry)	Stafford
8	28 29 30	Gloucester Oxford Buckingham	Mr. G. Durrant, B.V.Sc., M.R.C.V.S. (County Veterinary Officer, Leicester (Co.))	Oxford
9	31 32 33	Bedford Hertford Middlesex London Essex	Mr. S. B. Vine, M.R.C.V.S., (County Veterinary Officer, Kent)	Hertford
10	34 35 36 37	Kent Surrey Sussex (East) " (West)	Mr. H. Gooch, M.R.C.V.S., (Superintending Inspector of Ministry)	Kingston-on-Thames
11	38 39 40 41	Berks Southampton Isle of Wight Wilts	Mr. E. Brown, M.R.C.V.S., (Superintending Inspector of Ministry)	Trowbridge
12	42 43	Somerset Dorset	Capt. J. Fox., M.C.; M.R.C.V.S. (Divisional Inspector of Ministry)	Taunton
13	44 45	Devon Cornwall	Capt. G. Atkinson, M.R.C.V.S. (Divisional Inspector of Ministry)	Exeter

(b) WALES

Area No.	Comprising		Superintending Inspector (present appointment in brackets)	Station
	Divisions Nos.	Counties		
14	46 47 48 49 50 51	Anglesey Caernarvon Denbigh Flint Merioneth Montgomery	Capt. T. G. Millington, M.R.C.V.S., D.V.H. (Superintending Inspector of Ministry)	Ruthin
15	52 53 54 55 56 57 58	Radnor Cardigan Brecknock Morpmouth Glamorgan Carmarthen Pembroke	Mr. A. D. J. Brennan, M.R.C.V.S. (Divisional Inspector of Ministry)	Carmarthen

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(c) SCOTLAND

Area No.	Comprising		Superintending Inspector (present appointment in brackets)	Station
	Divisions Nos.	Counties		
16	59	{ Caithness Sutherland Ross & Cromarty Inverness	Mr. C. Macpherson, M.R.C.V.S. (Divisional Inspector of Ministry)	Inverness
	60			
	61			
17	62	{ Shetland Orkney Banff Moray Nairn Aberdeen	Mr. W. J. Young, F.R.C.V.S., D.V.S.M. (Superintending Inspector of Ministry)	Aberdeen
	63			
	64			
	65			
18	66	{ Angus Kincardine Clackmannan Fife Perth Kinross	Mr. J. N. Ritchie, B.Sc., M.R.C.V.S., D.V.S.M. (Chief Veterinary Surgeon, Department of Agriculture for Scotland)	Perth
	67			
	68			
19	69	{ Argyll Stirling Dunbarton Renfrew Bute	Major J. G. MacGregor, M.R.C.V.S. (Chief Veterinary Officer, Stirling (Co.))	Paisley
	70			
	71			
20	72	Ayr Wigtown Kircudbright	Major A. Douglas, M.R.C.V.S., D.V.S.M. (Chief Veterinary Inspector, Ayr (Co.))	Ayr
	73			
	74			
21	75	Lanark Dumfries	Mr. A. B. Kerr, M.R.C.V.S., D.V.S.M. (Chief Veterinary Officer, Chester (Co.))	Hamilton
	76			
22	77	{ East Lothian Mid- West Peebles Selkirk Roxburgh Berwick	† Major D. S. Rabagliati, O.B.E., B.Sc., F.R.C.V.S., D.V.S.M. (Chief Veterinary Officer, Yorks (West Riding))	Edinburgh
	78			

† Major Rabagliati will also act as veterinary liaison officer between the Ministry's Headquarters in London and the veterinary organization in Scotland on matters of general importance.

APPLE SCAB SPRAYING EXPERIMENTS IN THE WISBECH AREA—IV*

W. F. CHEAL, D.I.C.,

Horticultural Superintendent, Isle of Ely County Council

The control of Apple Scab, especially on Bramley's Seedling, is still a matter of difficulty with some growers; and samples of fruit in the markets frequently tell their own story. It may, therefore, be of interest if some of the more important points that have arisen from advisory and experimental work in a particularly bad scab area during the past three years are described.

Scab control is now largely a matter of following the spray programme advised for the particular locality, and only occasionally do orchards present special conditions requiring the adjustment of other factors. One example of such problems is that of orchard ventilation; the trees may require more room and their branches require better spacing. Good drying conditions are of prime importance in fighting fungus diseases. If a grower is in doubt regarding this, he should select two or three infected scab fruits on a tree and enclose them in paper bags or some such receptacle, and compare the rate of growth of the scab colonies inside the covers with those colonies on apples that are exposed and subject to drying atmospheric currents. The effect will soon be apparent. This experiment ought to be made by every student fruit grower.

Another example of subsidiary factors that may be of importance is that of grass undergrowth requiring more attention from the mower.

The fungicide to be used depends not only on the presence of other diseases and pests, but also on the spray tolerance of the variety. Lime sulphur is now the most popular fungicide on account, among other things, of its value in controlling Red Spider.

The timing of spray applications is of primary importance, not only in the West Country, where its value was first recognized, but also in most parts of the Eastern Counties, where there is less rainfall.

From trials conducted under various seasonal conditions—including 1937 with its wet June and July—there is no doubt

* Previous articles under this title appeared in this JOURNAL for February, 1933, December, 1933 and March, 1935.

APPLE SCAB SPRAYING EXPERIMENTS

whatever that the key to successful scab control, not only on wood-susceptible varieties, but also on some other varieties, including the important Bramley's Seedling, consists in two heavy pre-blossom applications of lime sulphur. There are still some growers who hesitate to carry out the pre-blossom spraying twice, or fail to use a sufficient quantity of lime sulphur per acre at this time of the season. The applications must be heavy ones; sparing use of fungicide has been a common cause of failure. Another fault more frequently made, and one that is very excusable, is delay due to the hesitation of the grower as a result of the leaf bud unfolding slightly later than the flower bud. There appears to be very little green foliage to which to apply the spray, and there is a tendency to delay the first application by a few days. This is fatal in a bad scab year.

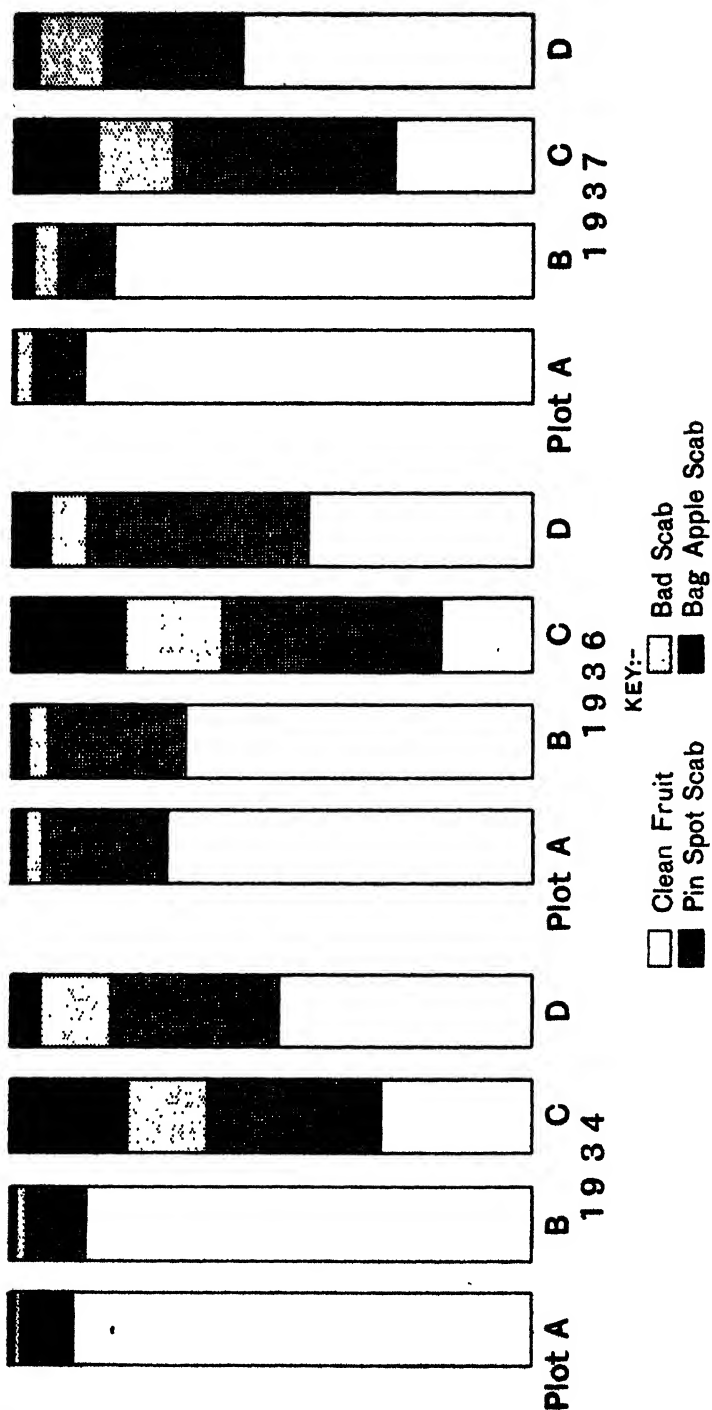
The following results of field observation on Bramley's Seedling trees in the Wisbech fenlands during the past four years, emphasize these points.

In 1934, scab colonies were abundant on Bramley's Seedling leaves by May 10, when only 20 per cent. of the blossom was open. From our knowledge of the time that it takes such colonies to grow, it is quite certain that this infection took place *before* the pink bud stage.

In 1935, the first scab colonies observed on Bramley's Seedling were found on April 29 in a grass orchard near Murrow, $5\frac{1}{2}$ miles distant W.S.W. of Wisbech, and in a cultivated garden near Upwell, 6 miles S.E. On April 30, scab colonies were common on young Bramley's leaves at Newton, 3 miles N. The blossom buds at Upwell were more advanced, but it will be noted that all these outbreaks—a considerable distance apart—were found at the pink bud and pre-pink bud stages. Green flower stage was general by April 25, pink bud by May 2, and petal fall was reached by May 22. It is clear that, allowing a period of 12 days for scab colonies to grow to a size visible to the naked eye under ordinary field conditions, a spray application, even at the green flower stage, April 25, would hardly have been soon enough in 1935. Further, to make the first application as late as the pink bud stage, May 2, when scab colonies were already established, would have been far too late. Fungicides are mostly preventive in their action, and are of little use once the organism has penetrated the plant tissues.

In 1936, a scab colony on a leaf of a flower truss of Bramley's

APPLE SCAB SPRAYING EXPERIMENTS



APPLE SCAB SPRAYING EXPERIMENTS

Seedling growing in a grass orchard 1 mile W. of Wisbech, was found as early as April 28 (advanced green flower stage). A bad outbreak was found on May 4 at Guyhirne, 6 miles S.W., and, on May 5, well developed colonies were conspicuous on young Bramley's leaves at two farms at Wisbech St. Mary, $3\frac{1}{2}$ miles S.W., at Tydd St. Giles, 6 miles N., and at Upwell, 7 miles S.E. Trees were in the pink bud stage by May 4, and petal fall by May 25. It should be noted that the period from green flower to pink bud was very prolonged in 1936; green flower stage was reached by April 4. This again emphasizes the need for extra pre-blossom treatment.

In 1937, the first scab colony was again found on Bramley's Seedling trees, 1 mile W. of Wisbech, when the tree was only in the pre-pink bud stage on May 3. Green flower stage was reached on April 21. More colonies were found on May 3 at High Fen, Murrow, 7 miles S.W., and at Guyhirne, 6 miles S.S.W. (trees just in the pink bud stage). On May 4, outbreaks were found at Leverington Common, 3 miles W., and at Wisbech St. Mary, 4 miles S.W. On May 6, a heavy outbreak of large colonies was found at Coldham, 5 miles S. Pink bud stage was generally reached by May 5, and petal fall by May 25. Throughout the blossoming period more scab outbreaks were found in gardens that had received their initial spray treatment only at the pink bud stage.

Field observation for the past four years on the initial appearance of fungal colonies on the leaves, has thus shown beyond all doubt that an additional pre-blossom spray has been necessary for the successful control of scab on Bramley's Seedling around Wisbech.

The results of spraying trials begun in 1931, and some of which have already been described in this JOURNAL,* have fully supported this evidence under very varied seasonal conditions, and shown the increased commercial value of the improved fruit from the adoption of a better programme.

The diagram opposite represents the percentage yields of scab-graded fruit obtained from experimental plots of Bramley's Seedling trees in 1934, 1936 and 1937, sprayed as follows:—

Plot (A)	1	..	2 pre- and 2 post-blossom applications.
" (B)	2	..	2 pre- and 1 post-blossom applications.
" (C)	3	..	Unsprayed.
" (D)	4	..	1 pre- and 2 post-blossom applications.

* This *Journal*, Vol. XLI, No. 12 (March, 1935), gives further details of the same plots of trees and the treatments given.

APPLE SCAB SPRAYING EXPERIMENTS

With the exception of 1934, the strength of the lime-sulphur in the post-blossom sprays was 1 in 80, and all the sprays were again applied with a hand-power machine. Frost destroyed the entire crop in 1935.

It will be seen that there has not been a steady increase of scab affecting the fruit of the unsprayed plot during the four years during which it has received no fungicides; there is thus no evidence of any accumulation of a possible wood infection on Bramley's Seedling.* Plot 2, receiving only one post-blossom spray, did remarkably well in the 1937 season of an abnormally wet June and July. A programme of two pre- and one post-blossom sprays has given consistently good results, even where a hand machine is the only sprayer available.

* The writer has not observed wood scab pustules on this variety.

THE EFFECT OF MANURES ON THE SIZE OF MAIN CROP POTATOES

H. V. GARNER, M.A., B.Sc.,
Rothamsted Experimental Station

It is only on the richest soils and under very intensive cultivation that growers have to reckon with a proportion of potatoes too large to be acceptable to the retail trade. In ordinary circumstances the aim is to secure as bold a sample as possible, more especially since the coming into operation of the Potato Marketing Scheme in 1934, under which minimum riddles are prescribed, as necessary, to meet changes in market conditions. The effect of the regulations is to exclude from the ware market all tubers that do not conform to the requirements. As a result of four years' working of this scheme, consumers have begun to appreciate and look for a higher standard, and this tendency will no doubt continue. Although tuber size is by no means the only criterion of quality it is the one of immediate practical importance, and the factors governing the percentage of ware are, therefore, worthy of consideration. The variety of potato grown, the richness of the soil, and the size of the original "seed" are among these factors, while manuring is also known to affect the result, some evidence of which is collected below.

When the riddle regulations of the Potato Marketing Board came into force in 1934, the determination of the percentage of ware potatoes for all the experiments carried out at Rothamsted, and its associated centres, was begun, and it soon became clear that large and statistically significant effects on tuber size were frequently produced by fertilizer treatment. Examination of the older Rothamsted and County series, for which the necessary data had been recorded, showed similar effects, which were undoubtedly real, although the design of experiments in those days did not lend itself to statistical interpretation.

The following is a brief summary and discussion of some of the main fertilizer effects observed in the modern experi-

THE EFFECT OF MANURES ON MAIN CROP POTATOES

ments published in the Rothamsted Station Reports for the three years 1934-36.

There were 40 trials in all, covering a wide range of soils. Sands, light loams, limestones, clays, warp, strong fens and light fenland were represented. Examination of the results of experiments giving marked fertilizer responses, both in yield and tuber size, showed that total yield and percentage of ware tended to move together, the treatments that gave high yields usually producing a high proportion of large tubers. This may be illustrated by the figures given in Table I for an experiment carried out at Rothamsted in 1935.

TABLE I
POTATOES: ROTHAMSTED 1935

<i>Treatment</i>		<i>Total Yield</i>	<i>Ware</i>	<i>Ware</i>
<i>Farmyard</i>	<i>Artificial</i>	<i>Tons</i>	<i>Per cent.</i>	<i>Tons</i>
<i>Manure</i>		<i>per acre</i>		<i>per acre</i>
No dung	Nil	3.9	52	2.0
"	N	2.8	36	1.0
"	PK	5.8	68	3.9
"	NPK	9.0	74	6.7
With dung	Nil	6.2	74	4.6
"	N	7.7	78	6.0
"	PK	7.4	76	5.6
"	NPK	10.4	81	8.4

Thus, sulphate of ammonia used alone gave the lowest yield, 2.8 tons, and the lowest percentage ware, 36 per cent. while the complete fertilizer in presence of dung gave the highest yield, 10.4 tons, and the highest proportion of ware, 81 per cent. When the pairs of figures are combined as in the last column of the table to give the yield of ware in tons per acre, the association of total yield and tuber size comes out in the big range of values recorded. Thus, the best treatment gave over eight times as much ware as the worst, but not quite four times the total crop.

The extent to which any factor, such as manuring, can affect the percentage of ware will naturally depend upon the actual amount of ware in the untreated crop. Thus, if the crop without fertilizer has a high proportion of ware, owing either to the special qualities of the crop itself or the use of a small-sized riddle, the degree of improvement is restricted. If the original amount of ware is small the extent of possible improvement is considerable. In Table II below will be found the effects of each type of manure used in the experi-

THE EFFECT OF MANURES ON MAIN CROP POTATOES

ments grouped in relation to the proportion of ware in the untreated crop:—

TABLE II

<i>Initial per cent. Ware No Manure</i>	<i>Increase in ware due to</i>						<i>Total No. of Expts.</i>
	<i>N</i>	<i>P</i>	<i>K</i>	<i>Organics</i>	<i>Dung</i>	<i>NPK</i>	
Over 90	- 0.4	- 1.1	+ 0.6	- 0.3			9
80-90	+ 1.2	- 1.1	+ 1.5	+ 0.7			34
70-80	+ 2.6	+ 3.6	+ 8.7	- 1.0	+ 5.5	+ 4.0	29
60-70	+ 0.7	+ 6.8	+ 8.4	+ 2.8	+ 15.2	+ 4.4	29
50-60	+ 16.8	+ 5.9	+ 15.8	—	+ 25.9	+ 22.4	9
Under 50	—	—	+ 20.3	—	+ 34.2	—	3

When the ware stands at 80 per cent., or over, the increase in size following the use of manures is quite small in the experiments under review, but as the initial size falls the extent of improvement becomes very marked, so that when the unfertilized potatoes yield under 50 per cent. of ware, increases of 20 to over 30 per cent. are recorded. The figures in Table II also indicate the types of manures that exert the biggest effect on tuber size under the prevailing conditions. Potash, dung, and complete artificial mixtures stand out as particularly effective in this respect. We may now pass on to discuss the action of the individual nutrients and their combinations.

The Effect of Nitrogen. Two types of nitrogenous manures were tested in these experiments: (1) Inorganic nitrogen as sulphate of ammonia, the form almost universally used in mixed fertilizers; and (2) Organic nitrogen, usually as dried poultry manure, but occasionally also as malt culms, fish meal or rape cake.

The effects on yield and percentage of ware may be summarized as follows:—

<i>Form of Nitrogen</i>	<i>No. of Expts.</i>	<i>No. of increases in :—</i>			
		<i>Total</i>	<i>Yield Significant</i>	<i>Total</i>	<i>Per cent. Ware Significant</i>
Sul./Amm. . .	34	33	23	23	9
Organic Manure	15	15	9	8	4

The well-known effect of nitrogen on yield showed up well in these experiments, and in approximately two-thirds of the experiments with sulphate of ammonia and half those with organic nitrogen the percentage of ware also showed an increase. This increase was statistically significant in about one-quarter of the experiments. That the percentage of ware is affected in the same direction as the yield may be seen from the fact that 12 out of the 13 statistically significant increases

THE EFFECT OF MANURES ON MAIN CROP POTATOES

in size were accompanied by significant increases in total yield.

The combined effect of the increase in yield and the percentage of ware was to produce the rather surprising result that the increase in weight of ware actually exceeded the total increase in crop produced by nitrogen. In one experiment, for example, the plots without nitrogen gave 13.63 tons of total crop with 82.1 per cent. of ware, and the addition of 2½ cwt. of sulphate of ammonia raised the total crop to 14.85 tons with 89.7 per cent. of ware. The actual weights per acre of ware amounted to 11.19 tons without nitrogen, and 13.32 tons with sulphate of ammonia. The increase in ware was 2.13 tons, while that of the total crop was only 1.22 tons. The nine experiments showing definite increases in percentage of ware gave an average increase of 1.72 tons in total crop and 1.91 tons in ware, the dressing of sulphate of ammonia being usually about 3 cwt. per acre.

The organic manures, although generally beneficial, were not quite so active either in respect of yield or ware as equivalent nitrogen in the form of sulphate of ammonia. The results from eleven experiments comparing the two types of nitrogen were:—

0.6 cwt. N per acre	<i>Increases, Mean of 11 experiments</i>	
	<i>Yield, tons</i>	<i>Ware per cent.</i>
As sulphate of ammonia ..	+ 1.6	+ 1.6
As organic manure ..	+ 1.0	+ 0.4

This result is in harmony with the findings of many other experiments in which the first years' effects of the above types of nitrogenous manures have been compared on farm crops.

Effect of Phosphate. In 23 experiments superphosphate was the form chosen; one only compared superphosphate with basic slag and the slag proved inferior both in its effects on yield and percentage of ware. The results may be summarized as follows:—

<i>No. of Experiments</i>	<i>Total</i>	<i>No. of increases in :—</i>		
		<i>Yield Significant</i>	<i>Per cent. Ware Total</i>	<i>Ware Significant</i>
23	22	12	15	2

Superphosphate showed more effect on total yield than on the size of the potatoes. The effect on percentage of ware was on the whole positive with the two instances of significant positive effects giving increases of 18.3 and 8.5 per cent. respec-

THE EFFECT OF MANURES ON MAIN CROP POTATOES

tively. In eight instances the effect on ware was negative, and one of these was significant, but these were the experiments in which the yield effects of superphosphate were smaller.

Effect of Potash. In all but two of the experiments sulphate of potash was the form chosen. Its action on percentage of ware was more striking and consistent than that of the other nutrients, especially when used in the absence of farmyard manure as shown below:—

<i>No. of Experiments Without dung</i>	<i>Total</i>	<i>No. of increases in :—</i>		
		<i>Yield</i>	<i>Per cent. Ware</i>	
		<i>Significant</i>	<i>Total</i>	<i>Significant</i>
17	17	10	15	12

In 8 of these trials potash increased both yield and percentage of ware significantly, the mean result of these 8 experiments being an increase of 3.25 tons per acre of total crop and 3.46 tons of ware. The quantity of sulphate of potash ranged from 2 to 3 cwt. per acre. In five experiments having a basal dressing of dung, potash was markedly less effective than in the absence of dung, but even in presence of dung the effect of potash tended to be positive. The most conspicuous effect of potash was on the light fenland soils, on which increases of 22 per cent. of ware were recorded. Even on the heavy loam at Rothamsted the ware was increased by 18 per cent. Potash on the heavy fenland soils had little influence either on yield or ware.

Effect of Dung. The early county experiments showed that dung had a pronounced effect on the size of the tubers, and this was confirmed in the three instances in which it was possible to include dung as an experimental treatment on small replicated plots. Thus at Rothamsted dung increased the ware by amounts up to 34 per cent., depending on the nature of the basal dressing, the dung effect being much less in presence of potash than in its absence. On a light fenland soil the figures were:—

				<i>Percentage increase due to Dung</i>	
				<i>Total Crop</i>	<i>Per cent. Ware</i>
No Potash ..	..	..	..	+ 52	+ 30
With Potash..	..	..	..	+ 17	+ 4

In one of the experiments at Rothamsted dung was significantly better both for yield and ware when put in the ridges

THE EFFECT OF MANURES ON MAIN CROP POTATOES

in spring than when spread and ploughed in on the flat in autumn.

Effect of Complete Artificial. As might be expected, when complete mixtures of artificials of the type commonly used for potatoes were employed, substantial increases in yield and moderate but significant increases in ware resulted. These effects were much larger in the absence of dung than in its presence.

Summary. The experiments show that fertilizers exert an appreciable effect in the proportion of ware potatoes, especially when in their absence the ware forms less than 80 per cent. of the total crop. In general, the action on total yield and ware is in the same direction, a substantial yield increase is likely to be accompanied by a moderate increase in percentage of ware. Potash is advantageous in promoting the formation of large tubers, phosphate is more variable in its action, but, none the less, shows a tendency to increase the percentage of ware. Nitrogen takes up an intermediate position, and sulphate of ammonia was more effective than organic manures when used on an equal nitrogen basis. Dung was very effective, partly no doubt on account of its content of readily available potash, and also because of the presence of all three nutrients. The addition of dung greatly reduced the influence of potash on ware, an effect already familiar in respect of yield.

A NATIVE AGRICULTURAL COLLEGE IN RHODESIA

MRS. E. G. BODDINGTON

Domboshawa is a pretty name meaning literally, in the native language, "Red Rock," though actually the granite hill thus indicated takes its colour from a yellowish-red lichen that grows on it.

Near this hill (situated about 20 miles from Salisbury, Southern Rhodesia) is one of the two Government Schools for training natives in various branches of agriculture. The site was chosen for the very unusual reason that it provided neither good situation nor suitable soil for the growing of crops, and that it lacked easily obtainable water. This choice was made so that the natives should be taught how to farm under difficult conditions, and turn a barren track of sand veld into fertile farm.

Here, too, natives are taught to utilize all the natural products of their country to the best advantage. Agriculture is taught them on the latest scientific lines, and the value of a rotation of crops is demonstrated every year. In the past year an average yield of 21 bags* of maize was grown over an acreage of 75 acres that had been under a good rotation. This is a really remarkable return from sand veld.

Brick making, building, blacksmith work and carpentry are carefully taught. In the carpenters' shop natives are taught to make their own tools whenever possible. Axe-heads that do good work have been made out of old motor-car springs, and wooden mallets are smoothed and finished with broken glass. Plumbs, levels and gauges are all made by the pupils themselves. All the buildings on the property, except the new Beit Hall to be mentioned later, have been erected by the pupils themselves, under the direction of African teachers and European instructors.

Elementary educational training is given in reading, writing, arithmetic and geography, and first-aid is not neglected. The pupils' handwriting, good English and earnest desire to learn might be a lesson to many European youths.

Chiefs have been invited this year, from their kraals, as an experiment, to see for themselves how their young men are

* 1 bag = 183 lb. including sack.

A NATIVE AGRICULTURAL COLLEGE

being trained. They will stay six months, living in a model village that has been built to show how natives can improve their own homes. Some of the Chiefs' councillors are very keen to learn brick-making and brick-laying, rather to the embarrassment of the white Instructor in charge, who is chary of reproving them in front of other pupils, earnestly hoping they will make better councillors than they do masons. However, there is little doubt that in time brick-built buildings will take the place of the mud huts now used in native kraals, except perhaps in partially uncivilized areas.

The principal aim of the Chiefs' course is that they may, with understanding, co-operate with the Native Agricultural Demonstrators whose training forms an important section of the School's activities. The Demonstrators spend all their time on practical farm work, except for a few lessons on agricultural science.

The main school consists of Standards to II to VII. Time per week is divided equally between academic work and industrial pursuits. In the former, the standards are kept as far as possible equivalent to those of European schools. In the latter, work and training varies between building, carpentry, and, mainly agriculture. Only after Standard IV are pupils allowed to specialize in one of the three industrial subjects.

The native youths themselves are intensely keen on learning, and, if their relatives cannot afford to pay their fees, they will go to work for a year and then come back and take a year's schooling with the money earned, and continue to do this until such time as their course is completed.

It is a mistake to imagine that the tuition given is competitive with white labour. The method of teaching is such that the natives can learn to improve their own conditions and set up a higher and more hygienic standard of living in their own Reserves.

Natives are very keen on animal husbandry, and at Domboshawa they are being taught to improve their cattle. All native cattle are hardy animals, but small, and at present are being crossed with a South Devon Bull to grade up size and form, and later they will be crossed back again with an Afrikaner strain to keep the hardihood necessary for the Rhodesian climate and maintain resistance to the various ailments to which cattle in Africa are susceptible.

When I visited Domboshawa a particularly interesting sight at the school was the beautifully kept cattle pens, each bearing

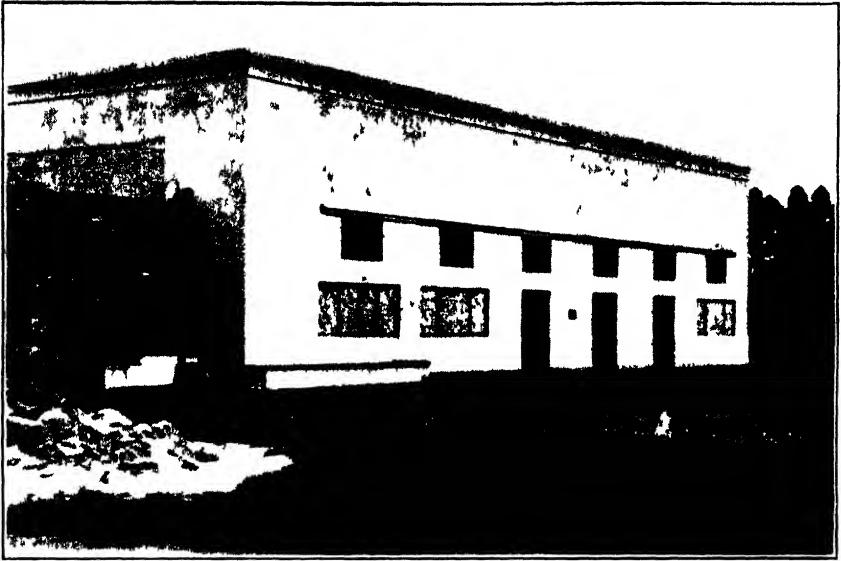


FIG. 1 The Bot Hull, erected by the Natives

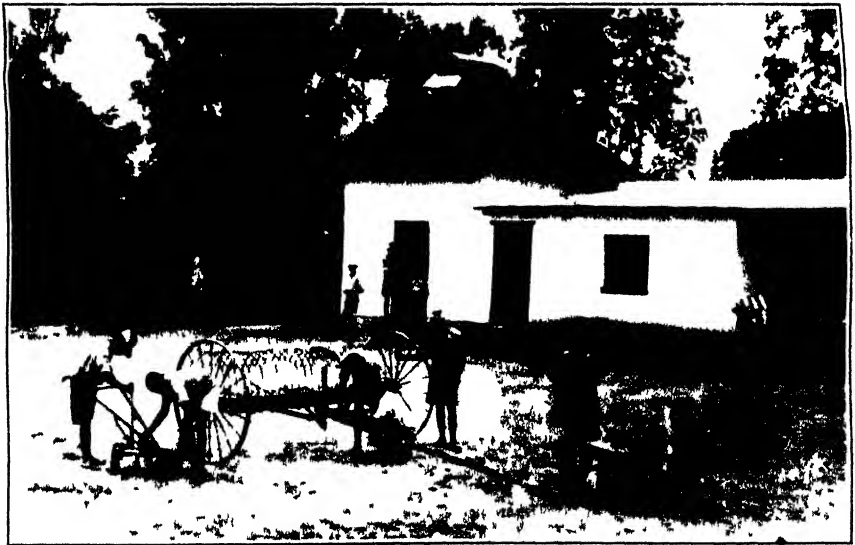


FIG. 2 Instruction in the Repair of Implements The Building in the background is the Dury

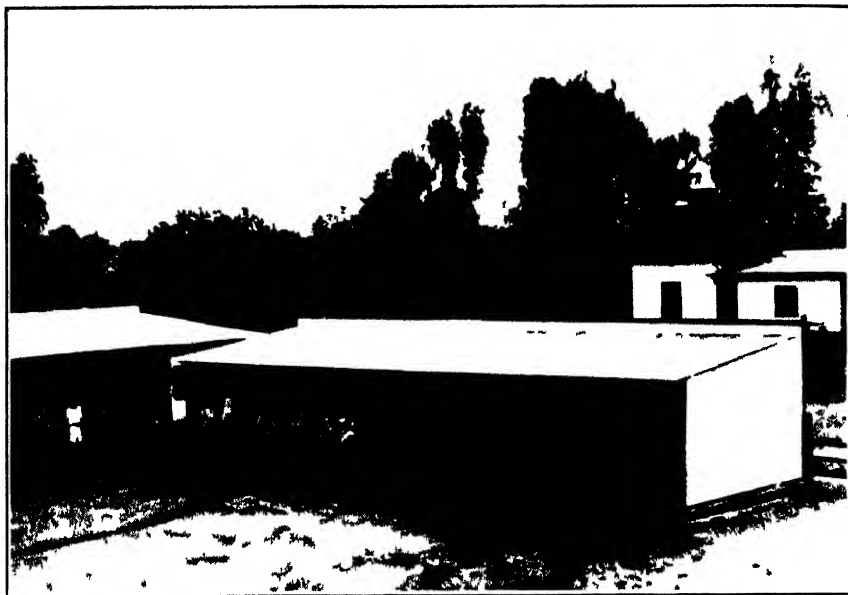


FIG. 3 A section of the Cow sheds



FIG. 4 Constructing School Benches and Beds in the Carpentry Shop

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the name of its occupant over the stall. So spotless were the pens that one man in the party involuntarily apologized to the Inspector of that Department for dropping his cigarette ash on the floor!

Under the trees were rows of ploughs, harrows and cultivators. All were in perfect condition, freshly painted; and spare parts had been put in, or repairs done so that everything was in order for the next time they were required. The Instructor in charge, an enthusiastic Irishman, said the implements were the pride of the pupils, and if only a few benefited from the instruction it would spread in the Native Reserves and the work would not be in vain. At present it is not only natives who are deplorably careless in this respect; only too often on farms under European direction may be seen implements lying about; and at the last moment, when an urgent call comes, it is found that much overhauling is necessary.

The forestry training of the school is another excellent institution. Every care is taken to preserve indigenous trees. A belt of exotic trees, moreover, is evidence of instruction being given in the production of other types of wood. The Eucalyptus is predominant, but attention is now being paid to better types of timber trees, including Toon, Syringa and varieties of Pine. Many decorative and flowering trees are also grown, notably the lovely Jackaranda. The school and forest nursery certainly provide many a useful lesson on the culture of trees, just as the tree-belts themselves provide the school with much of the timber needed for its building construction.

Every Sunday morning the pupils fall in for uniform inspection, and a march past the School-house, and then they attend an undenominational Church service, which is taken by Salisbury ministers or visiting missionaries. There is a small private chapel for those who wish to attend Holy Communion, or services under their own denomination.

During the past year the school received the distinction of being the first native Institution to receive benefit of funds from the Beit Trustees to build a Beit Hall, costing £2,500, and judging from the finished plans it will be a very fine structure. The Hall is provided with a large platform suitable for Church services or Concerts. The building was designed by Mr. Lynn Driver Jowitt, and the Hall, with a tower at one end, will be the central feature of the new school block.* At the moment of writing two offices and one classroom are in process of construction adjoining the Hall.

A NATIVE AGRICULTURAL COLLEGE

Some very fine plaques decorate the outside of the building, the work of Meyerowitz, depicting scenes of agriculture, pig, cattle and poultry farming.

There are 260 pupils at Domboshawa, but over 100 applicants have had to be refused owing to lack of accommodation. In September, 1936, over 160 applications for entrance in the following year had been received. Fees are £2 per annum, below Standard V, and £4 10s. per annum above. Naturally these cover but a small percentage of the cost of the school. The Southern Rhodesian Government, which meets the rest of the expense, however, has a type of school for African natives of which it may well be proud.

The domestic and recreational sides of the pupils' lives are well organized. The dining hall is spacious, and is furnished with benches and tables made by the pupils themselves. Open arches, all round, take the place of glass windows, and on the walls are some fine pictures of Rhodesian hunting and Rhodesian scenes, painted and presented by Col. Essex Capel, D.S.O.

Adjoining the dining hall is a large kitchen where maize or mealie-meal (the natives' staple diet) is cooked in huge boilers; for savouries they alternate meat, monkey-nuts and beans. In addition to the school supply, each pupil can have a patch of land on which to grow his own vegetables; pumpkins and onions being first favourites.

The new dormitories, which are gradually replacing the old, are models of hygienic cleanliness. Ruthless war is waged against bugs, the pest of the kraals, and only the privileged prefects are allowed mattresses of sacking filled with straw. Everything is aired all day in the sun, and only cement shelves are allowed for personal belongings.

Last, but far from least, all kinds of sport are indulged in. The Principal of the School, himself a keen athlete, supported by an enthusiastic European and African staff, has taught the natives all the tricks of the games, and made them almost invincible in matches against other schools and missions. This, together with the massed physical drill for which the school has in past years acquired a reputation, adds considerably to the esprit-de-corps of Domboshawa, and has indeed done much to spread its name amongst the million odd natives of the Colony, and far beyond.

CROP HUSBANDRY IN THE 18TH CENTURY: NORTHAMPTON AND LEICESTER

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For **Northampton** there is comprehensive evidence as early as 1712, and, while some progress in farming was made during the century, the county was reported to contain very little waste land at that date,^{1*} and neither Ernle² nor the Reporter to the old Board of Agriculture was very impressed by the position at the end of the century. Morton thinks the county was specially fertile and of the greatest note for grain, which was obtained with moderate labour of the husbandman.³ The soil in the county is very various, and in the inclosures of Peterborough continuous cropping for from seven to ten years was practised, the land then presumably being used for rape and allowed to fall down till restored.

On the common fields the usual three-course rotation seems to have been followed,⁴ and very little inclosing had been done in the county. Wheat, and beans or peas, were cultivated in suitable land, but on the land between sand and black clay maslin was grown in several places, or lammas wheat and mixed peas and beans. The sandy soil, which was known as the Ryeland, was sown with barley, rye and peas, while on the "stoney or kealy" soil, rye seems to have been general.

On the limestone soils some sainfoin was grown. Of wheat, the varieties were chiefly the white and red lammas, but other types were used; both Spratt and long-eared barley were grown, and some "rath-ripe" seed was imported from Wiltshire and Oxford, and black oats were preferred because of their early ripening.⁵ Ellis, indeed, claims for the county the first use of sainfoin for gravelly sandy soils, and says that it was introduced to Kent from here.⁶

In Morton's time colliery waste was applied as a manure,⁷ and lime was also used; indeed, the farmers represented to the writer of the revised report their indignation at the writer of the first for saying that none was used.⁸ Hale also tells us that on the sandy lands in this county and in Huntingdon, the land was ploughed deep, rags, skins and hoofs were buried and the land was then dunged; alternatively, heavy dressings of clay were given so that the soil was changed to a loam; a strong loam full of sea shells (creach in Suffolk)

* For References see p. 1203.

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was also used. The coleseed grown in Lincoln and Northampton, he says, are little known elsewhere, but the crop was general in the Fens. He also complains that potatoes were very little regarded in the county, although the soil of the northern edge was very suitable for them.⁹ The wheat stubble, both in this county and Leicester, was left high in order to protect the corn lying "in gripp," as the sheaves were bound by the reapers,¹⁰ and in both counties the farmers made a practice of building their bean ricks near water in order to let their hogs feed on them after Michaelmas.¹¹

When Young passed through the county in 1771, he found some turnips in the inclosures, and wheat, barley, rye, oats, some clover and tares fed off to horses. Coleseed was also grown, and the hogs were still fattened with beans to a great size at Naseby. One improver grew cabbages for cattle, and stated he had grown them for twenty years. The open fields were under the three-course system, but in the inclosures the Norfolk system had been adopted. Some hollow draining was done, but this was not in the grass land, which was all in broad ridge and furrow. The ploughs were both of the swing and wheel type, whereas only a few years before Mordant had said that the drag plough without wheel or foot was used. Young did not find a great deal of improvement when he visited the county again in 1785, and Boys speaks of the "infamous" three-field system in 1793.¹² An interesting statement made by Mordant is that a draining plough, costing three guineas, was usually bought out of the town stock or at the charge of the parish for the purpose of a very moderate kind of main draining. T.Q., who passed through the county between the dates of Young's visits, found the road via Kettering to Northampton more or less deserted, the inclosures being mainly pasture and the arable sluggishly cultivated, not manured and drained as inclosures ought to be; but from Northampton towards Oxford via Towcester and Brackley, he found uninclosed arable, more fully populated, and what he is pleased to call the evil genius of field (i.e., open-field arable) inclosing, had not yet exerted its influence, so different is his view from that of the really agricultural observers.¹³

Morton tells us that in his day Plot's *Natural History of Oxfordshire* (1696) would serve indifferently well for all the middle part of England,¹⁴ and this is confirmed at a later date by Marshall, although he seems to deal more particularly with

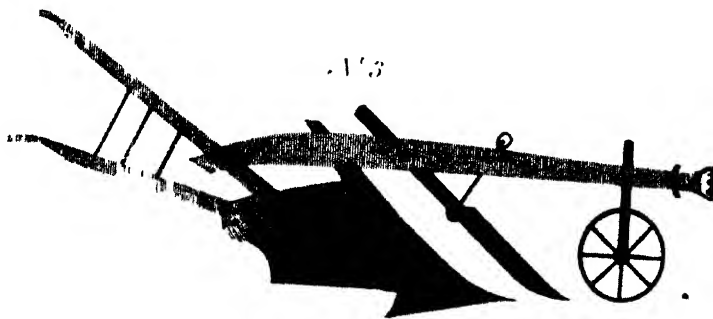
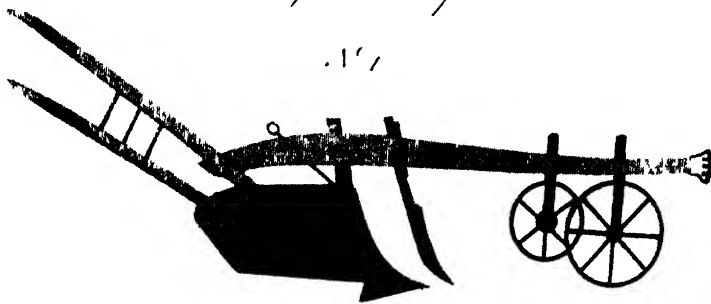
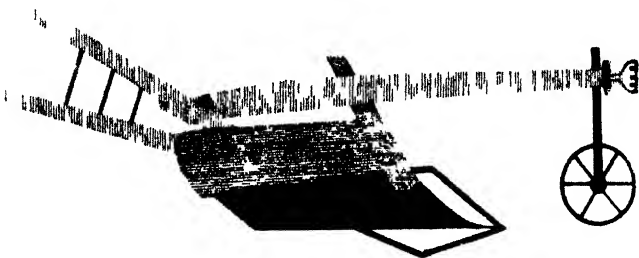


FIG 1 — A Selection of Ploughs from one of the earliest Implement Manufactories—
Messrs Hanford & Co, of Hathern in Loughborough No 1, Single Furrow
Plough, with Two Wheels No 2, Single Furrow Plough, with Skim Coulter
No 3, A Strong Plough, with a Stay to the Coulter

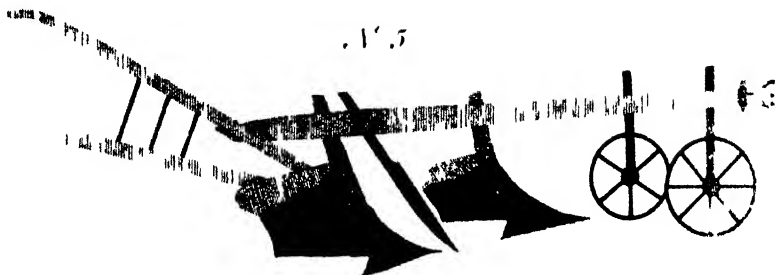
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Messrs. Hanford's Implements

No 4



No 5



No 6

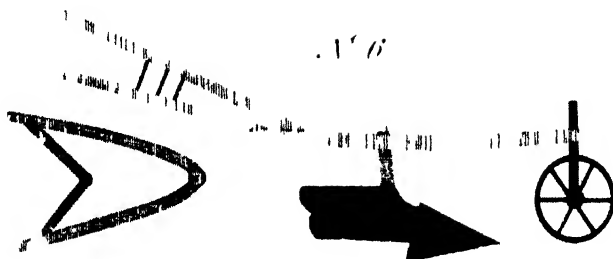


FIG 2 —A Further Selection of Ploughs from Messrs. Hanford's Manufactory
No 4, Trench Plough for Drain Cutting No 5, Trench Plough for Skimming
old Lurf No 6, Horse hoe Plough

18TH CENTURY CROP HUSBANDRY

Warwick and Leicester.¹⁵ The farms in the county were of moderate size, part of them being in the hands of yeomen, who either owned estates of some £300 a year or less, or rented farms to that extent. The average open-field farm was about 130 acres, and in the inclosed districts from 180 to 200 acres. Such tenants as there were, were chiefly from year to year, but a few leases for terms of 7, 14 and 21 years were granted.¹⁶ Donaldson does not add much to what we have learnt about the crops cultivated in the earlier part of the century, although he says that one-third of the tillage lands was regularly under fallow and another third regularly under wheat, of which a very great quantity was annually exported from the county, and a few potatoes were grown.¹⁷ It is true that he says there was little rye, which Pitt opposes, as he also does the question of potatoes, of which a good many were grown near Cottingham. According to Pitt, rye was used for bread, and turnips and field cabbages were grown on all the light soils, while the courses were very various in spite of the prevalence of the three-course system on the open fields.¹⁸ Few new implements had, however, been adopted in the county by the end of the century; there were a few drills, but Pitt neither saw nor heard of the threshing machine.¹⁹

For **Leicester** there are snippets of information scattered in the memoranda of Edward Lisle, who died in 1722, after farming at Crux Easton in Hampshire for nearly thirty years. He also had estates in Wiltshire and was by marriage connected with a Leicestershire family. For at least the major portion of the century it seems that the inclosed lands in the county were under the alternate system of husbandry. In Lisle's time they were accustomed to take four successive crops without dunging or folding, the first three being barley and the fourth wheat, and then to lay the land down to grass;²⁰ and long leys were still customary in Marshall's time, but the cropping had then been modified. It was oats, wheat, winter fallow for barley and seeds, then grass for six years. On the light lands turnips were sown between the wheat and barley,²¹ but the common fields were under the three-field system and were heavily cultivated, five ploughings being given for wheat and oats and four for barley.²² Lime was used at the rate of 5 quarters an acre, unslaked, in Lisle's time, and he also mentions the use of soot as a manure for wheat. The barley, oats and wheat were rolled, unless folded, and some peas, many beans and some rye were sown, while

18TH CENTURY CROP HUSBANDRY

turnips were not unknown, for migratory labour from Newtown (Wales) hoed the crop in 1707.²²

As early as 1724, when Defoe published his *Tour*, the county was more particularly engaged in breeding and feeding cattle, though he exaggerated the size of the farms, saying that it was not uncommon for graziers to rent from £500 to £2,000 a year.²⁴ Young does not report any farms larger than £900 of 18s. land, and those of the open fields were from £50 to £80 of 10s. land in his day. The course on the open fields had been modified in some districts, turnips and clover being introduced in 1771. There was then little sheep-folding, and the grass land was pared and burnt for turnips, and in some places lime was added. Some blackthorn drains were found, and Marshall thinks this method of under-draining had probably come from Lancashire via Stafford.

The graziers, Young thought, were foolish not to cultivate cabbages, as they were often forced to buy turnips from 'near an hundred miles off' for winter keep.²⁵ The county was one where yeomen were numerous, and it was the yeomen who were carrying out what improvements there were, the tenants being restricted in their methods by their leases.²⁶ Bray, indeed, complains that there were not many gentlemen's houses of note in the county,²⁷ and the County Reporter estimates that the farms, though of all sizes, lie between 80 and 500 acres.²⁸ The Reporter states definitely that the arable was less in proportion than in most other counties, and that in the south-east and middle of the county there were many farms without any whatsoever, which, if the topographers may be trusted, goes to show that a change had been taking place here. The earlier report indicates that the alternate system was still in force in some places, but the later suggests that the ley had been curtailed. The new crops, turnips and clover, had removed the necessity for a bare fallow, and though the Norfolk course was followed by some farmers, it had been lengthened by others. More barley than wheat was grown, and rye was only cultivated as a catch crop for spring feed for sheep. The oats area was wide, but peas were few and beans were going out of favour at the end of the century. Young's advice also seems to have been taken, for cabbages were "considerably cultivated," as were potatoes. The manures were still marl, lime, soot, ashes and compost.²⁹

Some developments had taken place in the implements used in the county. The plough was the common plough used all

over the midlands, but by Marshall's time the Rotherham or Dutch plough had been introduced, as well as a double-furrow plough that was originally brought from Worcester, but was now being made by Bush of Hurley in North Warwick, who seems to have driven a good business, as he also supplied Northampton. There were other types of plough, but, apart from their size, there was nothing out of the ordinary about the harrows. A simple roller was used, although there was a spiked roller at Lord Moira's. Between the date of Marshall's stay in the county and that of Pitt's report, the principal farmers had adopted Cooke's drill and several kinds of horse hoes. Shufflers or cultivators were used on the turnips and other fallows, and threshing machines had been fairly introduced into the county, while winnowing machines were made in it or nearby. Little is to be learnt of the wagons, but carts and tumbrils were used besides wagons.²⁰

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- ¹ John Morton: *Natural History of Northamptonshire*, 1712, p. 16.—
² *English Farming, Past and Present*, pp. 236, 244. (See also W. J. Ashley: *Bread of our Forefathers*, 1928, p. 30).—³ *Op. cit.*, pp. 9, 13. (See also Meager: *The Mystery of Husbandry*, 1697, p. 68).—⁴ Morton: p. 14. John Laurence: *New System* . . ., 1726, pp. 45, 83.—⁵ Morton, *op. cit.*, pp. 51–56, 477, 479, 480. Ellis: *Practical Farmer*, 1733, p. 9. *Modern Husbandry*, Oct. I ff.—⁶ *Chiltern and Vale Farming* . . ., 1733, p. 273 ff.—
⁷ *Op. cit.*, p. 14.—⁸ T. Hale: *A Compleat Body of Husbandry*, 1756, p. 8. W. Pitt: *Report*, 1809, p. 175.—⁹ *Op. cit.*, pp. 19, 44, 453, 502.—¹⁰ Edward Lisle: *Observations in Husbandry*, 2nd ed., 1757, p. 326. John Mills: *New System* . . ., 1767, p. 398.—¹¹ John Mordant: *Complete Steward*, 1761, p. 151.—¹² *Eastern Tour*, 1771, I, pp. 29–79. *Complete Steward*, 1761, p. 275. *Annals*, IV (1785), p. 151; VI (1786), pp. 456–500; XIX pp. 121–123, 137.—¹³ *Gents. Mag.*, XLIV, p. 411.—¹⁴ *Op. cit.*, p. 476.—
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²⁴ *Tour*, 5th ed., 1783, II, p. 373. (See also *Present State of England*, 1750, p. 145).—²⁵ *Eastern Tour*, 1771, I, pp. 80–104. *Midland Counties*, 1790, I, pp. 189, 225, 226, 272. *Annals*, XVI (1791), pp. 551, 605; XIX (1793), pp. 125–137.—²⁶ Taylor: *Decline* . . ., 1904, p. 33. *Introduction* . . ., 1905, p. 293. (See also Marshall: *Ibid.*, I, pp. 13–14).—²⁷ *Op. cit.*, p. 75.—
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A PRELIMINARY INVESTIGATION INTO THE OCCURRENCE AND CAUSES OF HAIR CRACKS IN HEN EGG SHELLS. II*

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Mottling. The water present in shells is evidenced by the mottling of the shell.[†] It is presumed that most—probably all—eggs are produced with mottle-free shells, and that the rapidity with which an egg shell can absorb moisture varies with the individual egg. These mottlings, examples of which are shown in Fig. 3, disappear in a warm, dry atmosphere until the shell appears to be perfectly plain. An increase in the moisture content of the atmosphere, however, has the effect of bringing back the mottles—the patches appearing in the original positions. The rate of disappearance and re-appearance varies with individual shells, and the success with which mottles can be induced in shells by dampening them varies considerably. Apparently the visible effect of moisture on hen egg shells is similar to that of oil on paper—the moistened patch becoming slightly translucent under the candling light. The external appearance of the shell under a normal light shows the mottles as faint greyish patches, and it is by these patches that buyers often judge the quality of the eggs when candling facilities are not available. It appears that eggs with these greyish patches are thought to be of poor quality or of some age. There is possibly some reason for this method of judging egg quality, since under normal conditions the shell is bacterium proof, but moisture lessens its impervious character.⁵

The egg with a heavily mottled shell is often rejected by candlers, although it is not necessarily of poor quality. A number of eggs with and without mottles, retained by the writer at normal atmospheric conditions, certainly showed that the eggs with mottled shells deteriorated rapidly. Sufficient evidence appears to be available to show that eggs stored at high humidities are open to the entry of many fungi,

* Part I of this Article appeared in the February, 1938, issue.

† For references see p. 1213.

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and it is a reasonable assumption that a shell that is either more moist, or absorbs moisture rapidly (i.e., easily mottles), is a poorer egg in the trade sense, than an egg that is not subject to mottling. It is on the contention that the damp egg shell is open to the entry of bacteria that the argument against washing is based.

In Fig. 3 four types of mottling are shown, which it is believed cover the entire range of mottling. The shell 3*a* is perhaps the most common type. It is proposed to call this type the patch mottle, since the distinctive features are the large irregular mottles, and the rapidity with which these patches spread over the shell. They are also easy to dry out, and their reappearance is easily brought about by wiping the shell with a damp cloth and exposing to a moderate warmth.

A very different type of mottling is presented by the shell of type 3*b*. The few pin-prick-like mottles appear under the candle as small translucent discs, and occasionally coincide with dimple-like dents in the shell. The number of those small mottles rarely shows any appreciable increase, and the mottles only disappear if drying is carried on for some time. It is also rather difficult to cause them to reappear.

A similar type of mottling is shown in 3*c*, where the small circular mottling is encountered in great profusion. The mottling is far easier to dry out or to cause to reappear. The type is rather uncommon, and, owing to the high-sounding clink emitted when two eggs of this type are tapped together, has been named "glassy" type.⁶

A further type of patchy mottle is shown in Fig. 3*d*. The patches in this type are not clearly defined, and have different degrees of translucency throughout the same patch of mottle. The appearance of shells with this type of mottle is usually poor, fragile, chalky and unattractive. The texture of type 3*a* is the thick, heavy-looking shell, emitting a low-pitched clink when tapped, and usually favoured by buyers. Type 3*b* presents a fine china-like surface, and is associated with the "glassy" type as regards the note emitted when lightly struck. The note of type 3*d* varies.

It is believed that the pitch of the note emitted by the various shells when struck is connected with the thickness of these shells. This belief is supported by the measurements obtained from eggs produced in the south-east of England. A sample case (180 eggs) was drawn from each consignment despatched to a packing station by eight large producers. It was known

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that certain of these producers were troubled with large numbers of hair cracks, whilst others were comparatively free from this fault. The contents of the sample case were candled during the same day in April, the eggs broken out, and the shells measured. The following table shows the average figure for the thickness of the four shell types of the eggs consigned by the eight producers (8 × 180 eggs):

TABLE I

Shell Type	..	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
Average Shell		mm.	mm.	mm.	mm.
Thickness	..	0·36	0·31	0·33	0·34
Range of Shell		mm.	mm.	mm.	mm.
Thickness	..	0·29–0·41	0·275–0·36	0·30–0·36	0·285–0·41

From these figures it appeared that patchy mottled shells (*a*) were thickest; the mixed type (*d*) and the two pin-prick types (*c* and *b*) following in that order. The range of shell thickness was greatest in type *d*—the mixed type, whilst the “glassy” type showed a comparatively small variation.

It was, of course, impossible to relate directly these figures for thickness, or mottle type, to the percentage of hair cracks, but the percentage of eggs with different types of mottles at the time of drawing the sample could be compared with the percentage of hair cracks in the consignment, and the average percentage for the whole year (Table II):

TABLE II

Producer		No. of Eggs under Mottle Type			Hair Cracks in Consignment %	Hair Cracks for Year %	Soil
		<i>a</i>	<i>b c</i>	<i>d</i>			
A	..	76	104	—	10·5	11·0	Sandy
B	..	44	86	50	17·5	14·0	Sandy Alluvium
C	..	53	86	41	10·0	10·5	Chalk
D	..	30	143	7	10·0	6·5	Sandy
E	..	58	122	—	7·0	7·0	Sandy Loam
F	..	119	69	—	3·0	2·0	Clay
G	..	70	69	31	5·0	2·5	Alluvial Clay
H	..	108	72	(not divided)	3·0	3·0	Clay

The first five producers consistently had large quantities of eggs rejected for hair crack faults. It will be noticed that the figures returned for the consignments (which were drawn in April—an average month from the point of view of production, weather, etc.) approximated very nearly to the annual figure. The variation was greater with the last three producers, who



FIG. 3. Four Types of Shell Mottling. Note Ghost lines and appearance of an air cell due to breaking away of membranes during blowing.



FIG. 4a Section of Shell showing Pin prick Mottle ($\times 200$)

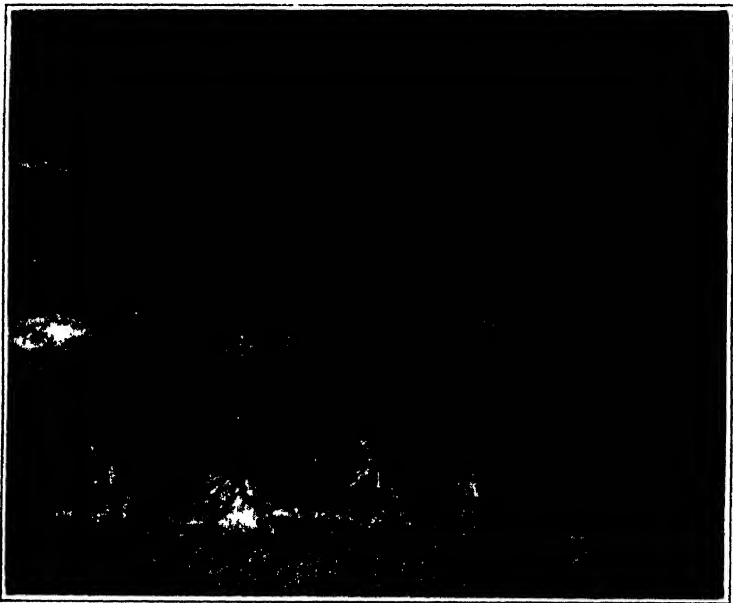


FIG. 4b —Section of Sound Shell ($\times 200$)

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had, however, low figures for their annual hair crack percentages.

The consignments with high hair crack percentages also showed that the majority of eggs had shells with the pin-prick type of mottle (types *b* and *c*). The reverse obtained with those producers where the hair crack percentages were low. Type *d* occurred both in consignments which contained many, and in those which contained few hair cracks. The main conclusions to be drawn from these figures appear to be that consignments subject to hair cracks have many eggs with the pin-prick type of mottle, and that the average shell thickness is less than that of consignments having few hair cracks, in which the majority of eggs have a patchy mottle. It must, however, be borne in mind that the distribution of type *d* makes an additional complication.

Effect of Shell Type on Egg Quality. Before proceeding to the account of the microscopical examination of the shell, some mention of the apparent effect of the various shell types on egg quality might be of interest. As far as could be ascertained from the records of the eight individual producers and others in the south-eastern area, it appeared that with eggs from producers in which shell type *a* was dominant, the keeping quality of the egg was comparatively poor, but the eggs from producers whose consignments were subject to hair cracks appeared to remain as first quality eggs for a much longer period. Examination of records and packs in packing stations in the south-west and the west Midlands showed that the number of eggs rejected for hair cracks was comparatively low—below 3 per cent. At the same time it was noticed that the eggs received in these western packing stations were predominantly (about 85 per cent.) of the patchy, mottled type, whilst it has been argued in an earlier article in this JOURNAL⁷ that the keeping quality of the eggs from these districts was comparatively poor. In view of Rettger's remarks and these observations it would appear that there is a strong relationship between keeping quality, shell mottling and thickness, and the liability of an egg to crack easily.

It seems obvious that shell type is intimately bound up with the problem of hair cracks, and, since the chemical composition shows such slight variations, it was thought probable that physical differences that were responsible for the shell types (rendered apparent by mottling) would be discernible

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under the microscope. With this end in view sections of shell were prepared from shells showing the various types of mottle, and from shells with and without hair cracks.⁸

The appearance of the horizontal sections showed no significant differences. The "pin-prick" portion of the shell showed a structure entirely similar to the remaining part of the shell, and the patchy mottle was also the same as the other parts of the shell. Eggs from the same consignment showed no variation in the appearance of the horizontal section between shells with and without hair cracks. The only discernible difference was the apparent variation in the amount of colouring matter (or protein), whilst a variation was also observed in the looseness of the crystalline structure. It is possible that eggs with a more open structure may be able to accommodate shocks more easily and so be less apt to crack. Although this avenue could not be fully explored, it is possible that it is a contributory cause towards the West Country's comparative freedom from hair cracks.

The only result of the inspection of the flat section was to establish the fact that there was no variation in the crystalline structure, and that the "pin-prick" mottles did not appear to be related to the porosity of the shells.

Similar inspections of the vertical sections of shell were much more satisfactory. Variations were observed between individual shells in the thickness of the shell and in the distribution of colouring matter (protein). It was also noticed that certain shells were not of the same thickness throughout. From the shells examined it was apparent that this variation in the thickness of individual shells took the form of "dimples" both in the outer and inner surfaces; the shell, in fact, appearing rickety (Fig. 4a). In the micro-photograph of this rickety shell the unevenness in the distribution of the protein material is at once apparent, and the shell presents a very ragged appearance when compared with the example in Fig. 4b. In the latter, an appreciably thicker shell will be observed, a much more even distribution of the dark-coloured protein, whilst the thickness of the shell is constant. Actually, the first example was cut from a shell showing a "pin-prick" mottle—the section passing across the centre of a pin-prick. It must, however, be stated that not all "pin-prick" mottles showed the "dimple" effect in the vertical structure. The second section was cut from a sound shell from the consignment of a producer whose returns showed him not to be

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troubled by hair cracks. The shell showed broad spreading patches of mottle (type *a*) under the candling light.

A number of shells showing the two distinct types of mottling (*a* and *b*) were examined, and the great majority repeated the characteristics observed in the two sections shown in Fig. 4. The "pin-prick" mottled shells were predominantly thinner and more ragged looking, but in spite of this uneven rickety texture the structure appeared to be very compact. The patchy mottled shells were usually thicker shells with an even texture. The great majority of shells from eggs with hair cracks, or from eggs in consignments from producers troubled with the hair crack problem belonged to the former class.

In the face of this evidence it is difficult not to conclude that "hair cracks" are apt to occur in the comparatively thin rickety shells characterized by the pin-prick mottlings. It is believed that the liability of these shells to crack easily is due, not only to the thin nature of the shells, but also to the uneven shell failing to transmit shocks evenly. Probably the uneven distribution of the shell matrix may also result in lines of weakness, and doubtless be the cause of the small pin-prick-like mottlings. This uneven distribution of the shell matrix (protein) presumably results in portions of the shell having a much more compact structure⁹, which, while it may lessen evaporation, causes the shell to present greater resistance to water and so inhibit mottling. The compact nature of the shell will, of course, make it more apt to crack.

Causes of Hair Cracks. Having concluded an account of the immediate cause of "hair cracks" in eggs, the question naturally arises as to the reason why certain eggs should have this fault and whether any remedy exists. The suggestion that certain hens only produce eggs that are apt to crack easily (i.e., have the "pin-prick" mottle) is not entirely satisfactory. It is freely admitted that the inheritance factor is most important in egg quality, but it is tentatively suggested that locality is also an important factor, and may be predominant if any deficiency exists in the diet. That diet deficiencies do not have an effect on shell texture and strength does not seem a reasonable premise.

The assumption that inheritance is the sole cause of shell differences (e.g., shell mottle, liability to hair cracks, etc.) does not appear to be at all satisfactory if Fig. 1 is inspected. Is one to believe that the distribution of satisfactory birds shows

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an annular pattern so closely related to the soil? It may be maintained that the quality of farming will be reflected in the quality of the poultry, but while it is difficult to believe that a good standard of farming would be maintained continuously throughout the same tract, it is conceivable that the type of vegetation produced on the adjacent farms would have much in common. It is in fact obvious that certain vegetational qualities would be confined to certain soil tracts, and it must be borne in mind that the percentage distribution of hair cracks showed a close relationship to the regional pattern.

It appears a reasonable argument to put forward that eggs with "hair cracks" predominate in districts of light sandy or chalky soils—soils on which the natural vegetation is light, although in the chalk areas the shell-forming material may be plentiful. It is interesting to recall in this connexion the fact that the mottle types *c* and *d* were not necessarily deficient in thickness of shell, although apparently subject to hair cracks.

The areas where producers are not greatly troubled by hair cracks are mainly districts of heavy loams and clays, land where the vegetation is rich. One would naturally expect the effect of the vegetation to be seen in the eggs of free-range poultry on land of this description, and, indeed, it is common knowledge that eggs produced on rich pasture lands—notably the west—are characterized by heavy rich yolks and dark shell colour. These eggs, however, are not usually of good keeping quality.

It is possible that both soil and vegetation may directly affect the shell. The former has been dealt with in a previous issue of this JOURNAL¹⁰, and it is not proposed to enlarge upon that problem in this article. Vegetational differences will, no doubt, affect the supply of vitamins A, D and E, and the supply of protein. It will be recalled that vitamin A is concerned with general health, whilst bone formation is influenced by the presence of vitamin D. Vitamin E is the anti-sterility vitamin, and is no doubt of some importance in the production of eggs.

It is suggested that eggs with *b*, *c* and *d* type of mottling, which are apparently subject to hair cracks, are due to a deficiency of vitamins A, D and E in the diet—vitamins that poultry on the heavier clay land pasture can naturally acquire. It is believed that lack of sufficient green food will cause poor health and result in poor egg production generally. A defi-

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ciency of vitamin D (which can be obtained from plant life) will have obvious effects on the bird, and induce a rickety condition in the poultry and possibly in the eggs.

A poor supply of green food will probably affect the protein content of the egg. The rich colouring of egg yolks is due to the colouring matter found in vegetation, and the withdrawal of this material from the diet of the bird will lead to a loss of colour, and presumably a lowering of the quantity of matrix found in the shell. It was particularly noticeable that the eggs produced along the Wealden Valley of south-east England had a rich yolk and shell colour. The shells in particular showed a heavy, almost earthenware-like, texture and appeared able to resist a blow that would have shattered the "glassy" type of shell. The quality may almost be described as "spongy."

In connexion with the Wealden Valley poultry, it is interesting to recall one poultryman's empirical test for good quality birds. This producer, situated on the sandy land above the Weald, stated that he judged his birds by the bright appearance of the outer ring of the eye. Within the Weald Clay Valley other producers demonstrated that on this ruling their stock must be remarkably good as the rings on the eyes of all their birds appeared to be very bright. It is no less interesting to recall that a common symptom of vitamin A deficiency in human beings is xerophthalmia, in which the eye appears with a ring-like thickening of the surrounding membrane.¹¹

Vitamin E is necessary for reproduction and this important material is found in the germ of plants. In many instances the grain given to poultry has the germ partly or wholly absent. In these circumstances the hen derives its total supply of vitamin E either from other sources of its artificial feed, or from the plant food it picks up by ranging. It is believed that the poor-textured thin shells are, to some extent, caused by deficiencies of this material, and this view is supported by the fact that poor-textured shells predominate in districts where the natural vegetation is poor. Further, the seasonal change in the number of hair cracks experienced by producers seems to find a logical cause in this explanation. The late winter and early autumn are both seasons when the light soil areas are either frozen or baked hard and the vegetational supply is at its minimum. One must also add to this cause of the production of poor-textured shells, the fact

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that at these two seasons laying is commencing or ceasing. Candler of eggs usually report poor texture at these two seasons of the year, and appear surprised that poor shells and weak whites—"summer eggs" in appearance—should be present in packs during bitter winter months. Indeed, the number of poor quality eggs found in easterly packing stations in winter is surprising, and many unsatisfactory packs are reported in the East Anglian area during the month of February.

Remedial Measures. If these reasons for the presence of hair cracks be accepted—reasons put forward only on the results of a preliminary survey, a request for some remedy is a natural consequence. As it has been argued that these shell faults are due to the absence of vitamins A, D and E, the poultry keeper must ensure that their stock have sufficient quantities of these vitamins supplied. They can be supplied in the cheapest form by sunlight and green food. Vitamin D can also be supplied by certain liver oils, which also contain vitamin A.

Vitamin E, the importance of which is being increasingly recognized, is found in the germ of plants. It has already been stated that the germ is often missing from the grain food supplied to poultry, and it would seem to be a more satisfactory state of affairs for farmers to supply their own green food. Certain grasses have a high vitamin E content, and this is also true of such plants as kale. Indeed, several poultry farmers have found that chopped kale (leaves and stalk) fed regularly to their poultry has had an extraordinarily beneficial effect upon shell texture.

One word of advice to poultry farmers is tentatively offered. It must be realized that modern poultry farming is highly artificial, and, with an increased output by the birds, the drain on the birds' constitution must be counteracted by other artificial methods. Even if this is done, slight changes in diet, changes in weather, etc., will have a significant effect on the eggs produced, and poultry farmers will have to realize that a high egg output must necessarily increase the egg faults unless they study both the more obvious diet factors and those small indirect factors that affect egg production. Some improvement in egg quality, no doubt, would be effected if there were a return to more natural methods. This, of course, would entail a diminishing egg production, and it is possible

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that poultry farmers would prefer the present method, with its concurrent exaggeration of the normal incidence of faults, but which at the same time maintains a high annual egg production.

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- ⁸ The shell sections were prepared by Mr. A. V. Weatherhead, of the Geological Department, King's College, London, who employed the technique of rock sectioning.
- ⁹ It may be also recalled here that an excess of carbonate in any bony material results in increased brittleness. Those parts of the shell from which the matrix is absent may be regarded as having an excess of carbonate.
- ¹⁰ *Jour. Min. Agric.*, XLIII, 1936, July.
- ¹¹ Harris, L. J. : Vitamins in Theory and Practice, p. 155.

MARKETING NOTES

Bacon Supplies in 1937. The following table shows the supplies of bacon (including salted pork and tinned hams) that were available from all sources for consumption in the United Kingdom in each month of 1937:—

Month	Great Britain Output†			Northern Ireland Output	Net Imports†	Total Supply of Bacon to the U.K.‡ Market
	From Home Pigs	From Imported Pigs*	Total			
1937	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>
January ..	153,100	31,200	184,300	54,700	607,800	846,800
February ..	131,300	30,900	162,200	49,800	579,700	791,700
March ..	149,400	39,400	188,800	52,400	672,100	913,300
April ..	172,300	44,100	216,400	51,800	642,200	910,400
May ..	162,500	49,500	212,000	41,300	695,700	949,000
June ..	160,700	43,600	204,300	36,800	613,900	855,000
July ..	164,600	55,500	220,100	58,900	618,500	897,500
August ..	171,900	55,300	227,200	60,700	632,400	920,300
September	191,300	50,000	241,300	68,000	555,700	865,000
October ..	191,200	37,300	228,500	69,000	598,800	896,300
November	158,600	35,000	193,600	60,800	649,500	903,900
December	137,600	36,200	173,800	58,300	652,000	884,100
Total ..	1,944,500	508,000	2,452,500	662,500	7,518,300	10,633,300

* Including Northern Ireland pigs shipped to Great Britain.

† Imports minus re-exports.

‡ Subject to revision.

Total supplies (exclusive of the output of the small registered curers) amounted to 10,633,300 cwt. compared with 10,644,000 cwt. in 1936.

Bacon Import Arrangements, January-April, 1938. In the light of recommendations of the Market Supply Committee foreign quotas for the four months January to April, 1938, were fixed at the same rate as that obtaining during the period October 15 to December 31, 1937.

The allocations to the individual foreign exporting countries are as follows:—

Country	Allocations <i>cwt. (a)</i>	Country	Allocations <i>cwt. (a)</i>
Denmark	1,087,954	Argentina	11,993
Netherlands ..	162,765	U.S.A.	137,065
Poland	136,208	Allowance for imports from	
Sweden	80,526	foreign countries not	
Lithuania	50,543	scheduled to the Bacon	
Estonia	12,850	(Import Regulation)	
Finland	6,853	Order	41,450
Latvia	11,993		
U.S.S.R.	14,563	Total	1,754,763

(a) Subject to amendment as regards certain individual countries in respect of overshipments or undershipments in previous periods.

MARKETING NOTES

Milk Marketing Scheme. The wholesale price for liquid milk (other than Tuberculin Tested milk) in January, 1938, was 1s. 6d. per gal. the same as in the previous month, but a 1d. more than in January, 1937. The wholesale price for Tuberculin Tested milk in January, 1938, was 1s. 8d. per gal., the same as in the previous month.

Pool prices for January, 1938, are given below, with comparative figures for December, 1937, and January, 1937.

				<i>Pool Prices</i>		
				<i>Jan.</i>	<i>Dec.</i>	<i>Jan.</i>
				1938	1937	1937
				<i>d.</i>	<i>d.</i>	<i>d.</i>
Northern	..	..	..	15½	15½	14
North-Western	..	..	..	15½	15½	14
Eastern	..	..	..	15¾	16	14½
East Midland	..	..	..	15½	15¾	14½
West Midland	..	..	..	15	15½	13¾
North Wales	..	..	..	15	15½	13¾
South Wales	..	..	..	15¾	15½	14
Southern	..	..	..	15¾	16½	14½
Mid-Western	..	..	..	15	15½	14
Far-Western	..	..	..	15	15½	13¾
South-Eastern	..	..	..	16	16½	14½
Unweighted Average	..	..	..	15·34	15·64	14·05

These prices are exclusive of any premium for special services and level deliveries, and also of the quality bonuses for Accredited and Tuberculin Tested milks. The estimated gallonage on which quality premiums have been earned was 30,973,571.

The inter-regional compensation levy was fixed at 1d. per gal., compared with 1½d. per gal. in January, 1937. Sales on wholesale contracts were as follows:—

				<i>Jan., 1938</i>	<i>Jan., 1937</i>
				<i>(estimated)</i>	<i>(estimated)</i>
				<i>Gal.</i>	<i>Gal.</i>
Liquid	..	..	..	51,769,973	48,145,121
Manufacturing	..	..	..	14,944,581	16,006,196
				67,714,554	64,151,317
Percentage liquid sales				77·59	75·05
Percentage manufacturing sales				22·41	24·95

The average realization price of manufacturing milk during January was 7.72d. per gal. compared with 6.25d. per gal. for January, 1937. The quantity of milk manufactured into cheese on farms was 593,753 gal. compared with 660,220 gal. in the previous month and 351,617 gal. in January, 1937.

MARKETING NOTES

Pigs Marketing Board. Annual Elections, 1938. The following unopposed candidates have been elected as district members of the Pigs Marketing Board:—

<i>South-Western District</i>	..	..	..	Mr. S. H. R. Eva
<i>South-Eastern District</i>	..	..	..	Mr. R. Rowland
<i>Eastern District</i>	..	..	..	Captain J. H. Wilson

Two candidates have been nominated in the East Midland District.

Hops Marketing Scheme. The 1937 crop fell somewhat short of the estimated market demand, and at the end of the period of trading which, by agreement between the Hops Marketing Board and the Brewers' Society, had been extended for a further period of 14 days, very few hops remained unsold.

The Board have made a final payment to growers which, with the two previous advances, represents 100 per cent. of the value of their quota hops less agents' commission and the Board's overhead expenses.

Potato Marketing Scheme. Census of Stocks. All registered producers and authorized merchants have been requested by the Potato Marketing Board to furnish returns showing the stocks of potatoes on hand on the night of February 12. A similar census has been taken in previous years.

List of Authorized Merchants. The Board have recently revised and brought up-to-date the list of authorized merchants, and copies of the revised list have been issued to all registered producers.

Amendments to Scheme. The Board have prepared certain amendments which they propose should be submitted to Ministers in due course. In accordance with the procedure laid down in the Agricultural Marketing Act, 1931, the Board have published the proposed amendments to all registered producers.

Consumers' Committee for England. The Consumers' Committee for England have made a report to the Minister of Agriculture and Fisheries on the terms of the Milk Marketing Board's contract for the year ending September 30, 1938. Copies of the report can be obtained free of charge from the Secretary, Consumers' Committee for England, 10, Whitehall Place, London, S.W.1.

MARKETING NOTES

The Committee was appointed under Section 9 of the Agricultural Marketing Act, 1931, to consider and report to the Minister of Agriculture and Fisheries on the effect of marketing schemes, applicable in England and Wales, upon consumers of the regulated products, and on complaints made to the Committee as to the effect of any such scheme upon consumers.

Wheat Act, 1932: Sales of Home-grown Wheat—Cereal Year 1937-38. Certificates lodged with the Wheat Commission by registered growers during the period August 1, 1937, to February 4, 1938, cover sales of 14,474,396 cwt. of millable wheat as compared with 13,710,534½ cwt. in the corresponding period (to February 5) last year.

Advance Payment to Registered Growers on Account of Deficiency Payments for 1937-38. In accordance with their Byelaw No. 31, the Wheat Commission decided to make a payment in advance to registered growers on account of deficiency payments that will become due under the Wheat Act for the cereal year ending July 31, 1938. This advance was made in respect of valid wheat certificates delivered to the Commission on or before Thursday, January 27, 1938, and was at the rate of 8d. per cwt., equal to 3s. per quarter of 504 lb.

The question of making an advance payment to growers who deliver wheat certificates after January 27 will be considered by the Commission.

Sugar Industry (Reorganization) Act, 1936: Production of Home-Grown Beet Sugar during 1937-38 Campaign. According to information furnished by the British Sugar Corporation Ltd., the total quantities of beet sugar manufactured in Great Britain during January, 1938, and the corresponding month in 1937 were :

			White cwt	Raw cwt	Total cwt.
1938	..	..	53,634	270,218	323,852
1937	..	..	669,784	800,222	1,470,006

The 1937-38 campaign has now closed and the total quantities of beet sugar produced during the campaign, with the corresponding figures for the 1936-37 campaign were :—

		White cwt.	Raw cwt.	Total cwt.
Campaign 1937-38	..	3,044,051	4,774,522	7,818,573
"	1936-37	5,375,716	5,371,670	10,747,386

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Livestock Industry Act, 1937. Cattle Fund. The following table gives particulars of payments made out of the fund set up under the Cattle Industry (Emergency Provision) Acts, 1934 to 1936, and the Livestock Industry Act, 1937:—

<i>Period</i>	<i>Payments</i> £	<i>Animals</i>	<i>Average Payment per Animal</i>		
			£	s.	d.
April, 1935, to January, 1936, inclusive	3,161,329	1,334,159	2	7	5
April, 1936, to January, 1937, inclusive	3,298,590	1,405,268	2	6	11
April, 1937, to January, 1938*, inclusive	3,209,576	1,311,951	2	8	11
From commencement of subsidy payments to January 31, 1938 ..	13,089,078	5,479,556	2	7	10

* The payments during this period comprised £1,357,847 for 581,712 animals certified under the Emergency Provisions Acts, and £1,017,129 for 314,627 animals of quality standard, and £834,600 for 415,612 animals of ordinary standard certified under the 1937 Act.

Approval Orders Under Section 14. The Livestock Commission, with the approval of the Minister, have made an Order under Section 14 of the Act approving the premises known as the Penrith Farmers' and Kidd's Auction at Kirkby Stephen, Westmorland, for use as a livestock market. The Order was necessitated by the fact that the market has recently been extended to include premises which were not used for the purposes of a livestock market during the year ended November 30, 1936.

A similar Order has been made and approved in respect of an extension to the Wharfedale Farmers Auction Mart at Leeds Road, Otley.

National Mark Egg Scheme. The total output of the 195 authorized packing stations operating in the scheme during 1937 was 502 million eggs, of which 85 per cent. were packed under the National Mark. This figure shows a slight decrease on the total output in 1936, attributable largely to the economic difficulties that have faced the industry during the past year. It is gratifying to record, however, that the quantity packed under the National Mark has increased from 418 millions in 1936 to 424 millions in 1937.

The year 1937 was the first complete year of operation of the reduced statutory grade weights which came into force in September, 1936. The increase in the proportion of eggs packed in the Special and Standard grades as a result of the

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revision of the grade weights has been very noticeable—81 per cent. of the total National Mark output falling into these two grades during 1937, as compared with 66 per cent. in 1935.

New features of the scheme introduced during the year include :

- (a) the use of standard returnable cases for wholesale trade under licence of the Minister ;
- (b) the improvement of the facilities for quality control inspections by the Ministry's Officers at packing stations ; and
- (c) an alternative specification for fibreboard egg cases as recommended by the Forest Products Research Laboratory (see issue of this JOURNAL for December, 1937).

National Mark Dressed Poultry. The aggregate output of the authorized packing stations during 1937 was 1,382,000 birds, of which 412,000 were packed under National Mark labels, including 15,000 turkeys and 100 geese that were graded and marked under the special National Mark Christmas Scheme for Turkeys and Geese. The National Mark output for this period is the highest recorded for any year since the inception of the National Mark Dressed Poultry Scheme in 1930, and represents an increase of 24 per cent. over the previous year's National Mark output of 333,000 birds.

The inspections of National Mark dressed poultry during the year indicate that authorized packers in the Scheme are complying satisfactorily with the prescribed standards both in regard to the quality of their produce and the method of packing. Some extremely good packs were seen.

The special arrangements for the application of the National Mark to turkeys and geese for the Christmas trade were repeated in 1937 upon precisely the same lines as in the preceding year. The number marked was about the same as in 1936, and reports indicate that generally the quality of the birds was exceptionally good.

National Mark Publicity. A National Mark " Week " and Exhibition will be held at Middlesbrough from March 30 to April 8, with the co-operation of the Civic Authorities. An appropriate exhibit will be staged at the Town Hall during this period, when a comprehensive range of National Mark products will be displayed. Samples of produce will be on sale, together with a selection from the Ministry's publications.

MARCH ON THE FARM

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Longer days, bright sunshine and indications of growth all round are features of the present month; another season, with all its hopes and fears, has definitely begun. March on most farms is a busy month and often an anxious one. Heavy snow at the end of the winter season may seriously check outlying stock. Sheep and lambs are likely to suffer, while on hill farms the losses may be serious. Weather is a most important factor for the arable farmer as well as for the stockman and flockmaster.

Much spring corn is sown during the month. Oats and barley have both commanded better prices during the past season, and it is interesting to note how this has acted as a stimulus to the farmer. During the period of low prices there was little enquiry from farmers as to the most suitable varieties to sow and manures to apply, but there has been a marked increase in the number of enquiries made in recent months.

The average yield of these cereals for the country, while better than that in most other countries, is still in the region of $\frac{3}{4}$ ton per acre. Cultural conditions, variety, quality of seed, manuring, soil and climate all affect the resultant crop. The first four are under the control of the farmer, and the neglect of proper attention to any one of these may result in reduced returns from the others. Money spent on good seed and manures may not be returned if cultivations are neglected, while good cultivations cannot make up for inferior seed and lack of manure.

From the point of view of cultivations, March is often a critical month. There is always an anxiety to push on with the work, and farmers are often tempted to be on the land when it is not fit. Soils, especially those of a strong character, may be put out of condition by working while wet, and if this takes place in spring there is often little opportunity, even with much toil, of restoring them.

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Although much attention has been given in recent years to the scientific study of cultivation, it remains true that it is an art only acquired by experience and close observations of the behaviour of the particular soil or soils worked by the farmer. Mechanization has become more general and has entailed the frequent reconsideration of methods and conditions for crop growth. The problems that have arisen on many farms after work by the gyrotiller are an example of this.

Manuring of Leys. Some of the advantages of alternate husbandry were referred to in the February notes. A productive temporary ley is a prime necessity for the success of this type of farming. While seedbed and the right seeds mixture are important, manurial treatment must not be overlooked, as the satisfactory development of the grasses and clovers sown is largely dependent on the encouragement afforded by suitable manuring. When making up a seeds mixture, plants that are productive and capable of persisting under the climatic and soil conditions are included. If these are not kept in vigorous growth, the competition of less productive plants results in their disappearance. For example, in Northumberland, on boulder clay soils, Bent Grass and Crested Dogstail very quickly make their appearance if the better types of plants are not able to compete satisfactorily, while, on the lighter soils, Yorkshire Fog soon appears. Once these plants become established in a ley, they will persist to the end.

If Wild White Clover, now invariably used in mixtures for the longer temporary leys, can be kept vigorous by suitable soil conditions and manuring, it quickly spreads and holds the ground against the inroads of weed such as those mentioned. This plant and Perennial Ryegrass are particularly valuable in that they give a good sole to the sward and keep out, or suppress, undesirable plants.

The chief aim of manuring should be to ensure a good clover plant, and for this purpose phosphatic manures are most important. The choice of the phosphatic manure depends very largely on soil conditions. With plenty of moisture and some acidity, North African phosphate has given very satisfactory results. When the soil is less acid, highly citric-soluble slag usually gives better results than North African phosphates. On dry soils with plenty of lime, superphosphate may be preferable. Acidity is always a disadvantage

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for young seeds because it hinders the successful establishment of the wild white clover and the better grasses. In many instances, the application of lime to such soils has been the best method of their improvement. On the strong clay soils of the north of England, potash manures have not been so necessary for pasture land, but on the lighter soils there is frequently a marked potash deficiency, especially where farmyard manure has not been liberally applied.

The roots of the Wild White Clover, once established, provide sufficient nitrogen for the needs of the grasses, and it is usually better to allow the grasses to depend on the clover root for their nitrogen than to make direct applications. When the latter is done, however, the grasses may compete so successfully as to reduce the proportion of clover in the pasture. Where there is special need for an early bite in spring, nitrogenous manures are sometimes used with success. In the north of England, however, the chief limiting factor to growth in spring does not appear to be lack of nitrogen, but weather conditions. Even where an early growth has been secured, it is doubtful if it can be fully utilized in all seasons, for it has a strong laxative effect on the grazing stock, which is especially harmful during spells of cold weather.

Nitrogenous manures should be used only for special purposes. The main needs of the pasture, as far as manures are concerned, should be met by phosphates and potash. It should be borne in mind that higher productivity demands a higher standard of management of the grazing stock.

For land in comparatively good heart, nitrogenous manures are not to be recommended in the early stages of the establishment of a ley. When applied at the time of seeding, they tend to produce increased straw in the nurse crop, which may then become laid and so smother or overshadow the young plants. Nitrogen further tends to encourage the grasses, so that they are able to compete unduly with the young clover plants.

On strong land in the north of England, an application of 10 cwt. of high-grade basic slag to the maiden seeds is customary where the grass is to lie for about 3 years. If, as is frequently done, the ley is left for a longer period, perhaps for 10 years, a dressing of 5-8 cwt. basic slag is usually given at 3-year intervals. Although it frequently happens that no apparent return is obtained for the addition of potash, there are instances where

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potash manures show good results in better returns from the stock, even on clay soils. On the lighter soils, profitable returns are usually obtained from the use of potash in addition to phosphates, the rate of application being 5 cwt. of basic slag and 2 cwt. kainit or potash salts every three years.

Farmyard manure gives variable results in the north of England. On very poor soils, particularly those that are sandy in character, it is frequently found that a liberal dressing of farmyard manure, applied before the seeds are sown, assists greatly in obtaining a good "take." Where, after one or two years, the sward has become very thin or dry, dung has proved useful in helping the recovery. In Cumberland and Westmorland, farmyard manure is frequently applied to young leys in the first year, and good results are obtained. On the stronger soils in Northumberland, however, and once a good take has been obtained, farmyard manure has frequently given results much inferior to those obtained from phosphates; this is true both for hay and pasture.

At Cockle Park on boulder clay soil, 10 cwt. of high-grade basic slag applied every third year gave an average yield of 32½ cwt. of hay, while 10 tons of dung in addition to 10 cwt. of high grade basic slag has given, on an adjoining plot, only 29½ cwt. of hay. The effect of the dung has been to produce a much more uneven sward, characterized by more top growth, but lacking in the uniformity and thickness of the "slag alone" plot.

The great necessity for suitable phosphatic manuring for the development of a good Wild White Clover ley is shown by the following results from plots sown at Cockle Park in 1906. For 11 years thereafter the average crops of hay per acre were as follows:—

No basic slag, no wild white clover	5½ cwt.
No basic slag, but with wild white clover	9½ "
Basic slag and no wild white clover	23½ "
Basic slag and wild white clover	34 "

Early Management of Leys. The early management of the ley is important. The ultimate composition and character of the sward depend to a very large extent on the treatment received in the early years. Provided a satisfactory plant of seeds has been obtained, it is usually best, except perhaps on light sandy soils, to take a hay crop in the first year. It is important, however, that this should be cut early, for if it is allowed to become too mature the plants, especially Perennial

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Ryegrass and the cultivated clovers, are considerably reduced in vitality. The aftermath is best grazed; if allowed to grow for a second cut of hay, the grasses and the wild white clover are overshadowed by the single-cut Cow Grass and do not become well established in the autumn before bad weather sets in.

Special care is needed to control the grazing in subsequent years so that there is an opportunity for both clovers and grasses to become established. Wild White Clover benefits from heavy grazing. Cocksfoot, which does not become well established in the north of England in the first year, will not tolerate the same degree of close grazing as wild white clover and perennial ryegrass. If closely grazed in the early years, little Cocksfoot may remain in the sward. Many farmers consider that Cocksfoot is a most important constituent in the pasture, since a good mixture of grass and clover is provided when it is present in suitable quantity. Without Cocksfoot there is frequently a tendency for wild white clover to dominate the Perennial Ryegrass, with the result that the bulk of the pasturage consists of clover. Stock do not thrive so well on pastures where clovers provide the bulk of the herbage: in the moist climate in the North of England the high protein content and the succulent character of the clover cause scouring. Cocksfoot is also valuable when it is desired to take a hay crop. Provided it is cut early, it gives a large amount of hay of good feeding value. It has already been said that Cocksfoot will not tolerate severe grazing, and in some instances, where there are signs of falling off in the amount and vigour of the Cocksfoot after pasturing for a year or two, it has been found advisable to take a hay crop, the rest period enabling the Cocksfoot to become re-established.

While careful control of grazing is important for all pasture land, there is need for special consideration of land newly laid down to grass. Too light grazing tends to give patchiness, allows seeding and may check the development of the Wild White Clover. If Wild White Clover is not developed in quantity, it is usually found that the Perennial Ryegrass dies out at the end of three or four years.

The class of grazing animal has a very distinct effect on the pasture produced. Horses are bad grazers and should not be allowed on young leys; they are curiously selective, and bite ~~the~~ closely in particular areas, and their neglect

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of areas where their dung is deposited causes these to become coarse.

Sheep alone are unsuitable grazing stock for much of the better pasture land. They have greater selective powers in grazing than cattle and choose the finer bottom or leafy herbage, refusing the stronger portions of the herbage and the flowering stems.

At Cockle Park it was found that, when sheep alone were used for grazing improved pasture, only one-half the live-weight increase per acre was produced as compared with that obtained from a mixed stock of cattle and sheep. In the early life of a pasture it is particularly important that some cattle should be run with the sheep stock; with sheep alone it is very difficult to prevent a large number of the plants sending up flowering stems, unless by grazing so heavily as to check seriously the Cocksfoot and Timothy. Cattle are the best grazing animals because they graze much more evenly than other stock.

Young leys are not so suitable for wintering stock, especially cattle. Apart from the fact that cattle do not thrive well because they lie cold and wet, they plunge the ground. Young pastures are characteristically more open and free from turf than old ones, and heavy treading may be very harmful.

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Tractor Ploughing. From the rather limited amount of general information that is available, it would appear that the estimated rates of ploughing tabulated in the January number of the JOURNAL represent at least double what is actually accomplished on most farms. For example, accurate records covering some 700 acres of medium-land ploughing on one farm show that a track-laying tractor of rather under 20 drawbar h.p. averaged about 0.56 acres per hour; whereas, according to the estimates referred to, it should have achieved at least an acre per hour. A still greater difference, between estimate and practice, is disclosed by the figures given by North* for the rate of ploughing on his farm. Two tractors were concerned, one of 12 and the other of 25 drawbar h.p., and together they averaged only about 0.5 acres per hour on the farm, against an estimate of something like 2 acres. In both instances the differences are large enough to be worthy of inquiry.

In the first place it must be remembered that the tabulated estimates are not purely theoretical, since they represent the performances actually achieved by tractors during a full day's work under strictly practical conditions during the recent R.A.S.E. tests. In particular, they include full provision for time lost in turning and in clearing the plough. On the other hand, there are two factors that are not covered. First, on the farm the appearance of the work is generally at least as important as the acreage covered, so that, particularly in starting a field, rather more time might be devoted to setting the plough than was done in the tests. Secondly, the time spent on servicing the tractor at the beginning and end of a day's ploughing would, in most farm records, be charged against the ploughing itself. However, if one were to allow a full hour per day for these, there would still be an uncomfortably big margin between estimate and performance.

Nor can it be objected that the difference lies in the fact

* Roger North. "The Application of Power to Farming." This *Journal*, XLIII, June, 1936, p. 225.

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that under test conditions the operators were keyed-up to cover the ground as quickly as possible regardless of personal comfort or inclination; for from the records it was possible to make for every tractor, a fairly reliable estimate of the "lost time"—that is, the difference between the time actually taken to plough a given acreage and the theoretical time calculated from speed and working width. As was to be expected, the lost time varied inversely with the length of the work (the longer the furrow the less the time lost) and directly with the width of the implement, because with a wide plough, and particularly when two were coupled together, more time was wasted in manoeuvring on the headland. But, quite apart from these causes, there were enormous variations from one tractor to another; and since in some instances as much as 20 per cent. of the total time could not be accounted for, it is to be assumed that on the whole the operators were not out to break records.

The one outstanding difference between the tests and ordinary farming was simply that, in the former, the tractors were provided with implements wide enough to utilize their full power, while in the other they are only too often under-loaded. In this connexion two instances noted by the writer during the last month or two are of interest. In the first, two tractors were working side by side with exactly similar ploughs. According to test figures, one of the tractors was just 40 per cent. more powerful than the other—and, incidentally, had cost nearly twice as much. Yet both machines were working in bottom gear with the result that the less powerful one was doing appreciably more work than the other because it happened to be slightly higher geared. In the second instance a farmer was anxious to demonstrate that, owing to careful maintenance, his 3-year-old track-laying tractor of about 19 h.p. had not lost any of its original power, and he therefore provided it with what he thought was a full working load. Dynamometer records showed that it was actually developing only 9 h.p. as loaded by the farmer, but was nevertheless capable, with proper loading, of doing nearly twice as much.

Small Tractors. Just recently the writer has had to deal with a number of inquiries about tractors suitable for small-holdings; and has found that in most instances it is very difficult to give a satisfactory answer. A typical instance is

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a holding of 50-60 acres devoted mainly to livestock—a few milking cows and some pigs and poultry—but including some arable land that received liberal dressings of muck. We need not ask whether there is a case to be made out for using mechanical power at all on such a holding, because for the moment a good enough answer is provided by the inquiries themselves. They show that many small-holders would like to use a tractor if only they could find one suited to their requirements. These requirements will, of course, vary with circumstances, although in general terms they are not difficult to define.

In the first place, unless the holding is devoted to intensive market gardening or some similar highly-productive enterprise, comparison with larger farms would suggest that the tractor should not exceed 5-6 drawbar h.p., and, including any equipment specially connected with it, should not cost more than about £150. Even these figures are on the high side, and their justification lies mainly in the fact that an ideal tractor will allow much more work to be done by "family labour." The real difficulty, however, comes when consideration is given to the various jobs, besides ordinary ploughing and cultivating, which the machine must tackle if it is to be worth having. These include all the operations of grassland management and haymaking; haulage of various kinds, and particularly dung carting; and, almost always, some form of row-crop cultivation. The possible tractors include a wide range of two-wheeled market-garden cultivators; one or two small track-laying machines; and possibly one or two of the smallest of the wheel tractors used on larger farms. Of these, only the two-wheeled machines meet the situation as far as cost is concerned; and they fall rather short of what is required as regards the work. The more powerful of them would tackle the ploughing, seedbed preparation and row-crop cultivation satisfactorily. They might even, with a suitable attachment, manage the mowing, although this will often be rather heavier work than the size of farm would suggest. Having regard, however, to the way in which the load varies as the implement jumps about, grassland harrowing, if severe enough to be worth doing at all, would probably be altogether too much for the man in control. As for the other jobs—haymaking, harvesting of whatever crops are grown, and transport generally—they would be out of the question unless a good deal of ingenuity, and

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probably quite a lot of money, were devoted to contriving suitable attachments. Both the available track-laying machines are too expensive; the cheaper of them is also too limited as regards speed of operation, and neither is very well suited to row-crop work.

From every point of view something like an ordinary wheel tractor would best fill the bill; but even the smallest of those now on the market is rather too large to use economically with existing horse-drawn implements, some of which a small-holder would quite rightly want to utilize if possible. The position is, in fact, that none of the inquirers gets a very satisfactory answer, so that most of them presumably give up the idea of mechanical power and carry on with horses as before. Yet it would not be at all impossible to provide something like the ideal; not track-laying, because tracks are too expensive; and not two-wheeled because if the machine is self-supporting it will be so much more adaptable; power enough to plough one good furrow; wheels convertible for road use; and the price as near £100 as the maker can manage.

Muck Carting. There has been so much discussion in recent years about the uses and abuses of farmyard manure that it is surprising that so little progress has been made towards improved methods of handling the material. It is not as if any ordinary form of livestock farming could be carried on without the dung cart; whether one believes in it or not, there the stuff is and someone must load and cart it somewhere; and the job is usually both unpleasant and expensive. On the Continent rather more attention has been devoted to the subject, although few of the devices that have been evolved from time to time can be said to have come into very general use. In America, on the other hand, the dung-spreader is a prominent feature of most stock farms, but even then only tackles the easiest end of the problem and leaves the more difficult job of loading to be done by hand as before. Continental devices vary in complexity from elaborate permanent systems involving overhead run-ways and tipping carriers to simple elevator-loaders or grabs rather on the lines of a hay fork.

The more elaborate of these devices can be left out of account here, because most of them could not be installed in connexion with existing buildings without practically reconstructing them from the start. In any event, these permanent

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systems do not take the dung right to the field, but only to a dump from which it must be re-transported later. Of the simpler devices—the elevator-loader and the manure fork—the former would appear to be the most likely to succeed on account of its greater adaptability. An earlier German report on the subject claimed that an electrically-driven loader reduced the costs of handling an annual output of about 2,000 tons of dung by rather more than one-third, even when 25 per cent. of the first cost was charged for depreciation and maintenance. This outfit cost round about £60 and could, of course, have been driven equally well by a portable engine. It cannot, however, be assumed that this device would have worked equally well under our conditions, because in Germany dung-making generally follows an elaborate ritual, and to carry out the long unrotted stuff that we often handle would be regarded almost as a crime.

Incidentally, a British loader that made its appearance two years or so ago included a device for breaking up long or matted dung, but the writer has heard nothing of the machine since it appeared and so can give no particulars about its performance. The German report, already referred to, also claimed for mechanical loading and handling devices that they greatly increased the efficiency of manuring by making it easier to apply the dung at the right time and without wastage. A rather similar claim might be made on behalf of tractor-hauled dung spreaders or any device that would speed up carting and distribution as distinct from loading; for, even on the farms of the most devoted adherents of organic manuring, the effects of concentrating the doses on the fields near the yards to the neglect of those situated at a distance are very often evident. Now that pneumatic-tyred tractors and trailers are generally available, only a little attention to the approaches to the yards is necessary to allow high-speed dung carting to be practised on any farm. With a little more attention to the dung-heap itself, so as to reduce the amount of long material, there is no reason why mechanical spreaders of the American pattern should not be much more generally used. The latest types of these machines are specially adapted for tractor use with a power take-off drive and a two-wheeled trailer body with a capacity about double that of earlier patterns.

Combined Seed and Fertilizer Drills. In a note read at

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the recent Oxford Conference the writer suggested that British manufacturers have not yet gone to the length of building a combined corn and fertilizer drill. This suggestion was incorrect, for according to later information, some British implements of the kind are made; and one firm, at least, has been making them for something like 60 years. On the other hand, the suggestion had this much truth in it; that combined drilling—regarded as a method which is rapidly gaining ground all over the country, and not as one which may have been practised long since in isolated districts—is a new development, definitely associated with the tractor. As such, the method, together with suitable machines—that is, machines wide enough for tractor use, but light enough for convenient handling, and at a reasonable price—was imported from overseas, just as many other ready-made devices were, when the move towards mechanization began 8 or 10 years ago.

It would, however, be interesting to know just why some British farmers went in for combined drilling as long as 60 years ago; for the recent move towards the process seems to have arisen mainly from the modern urge to hurry things up by doing two jobs at once; and it is only recently that it has been claimed that the process leads to more efficient manuring.

NOTES ON MANURING

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Spring Applications of Nitrogen for Cereals: *Wheat.* Developmental studies of this type made on the wheat crop have shown that the way in which it responds to nitrogenous fertilizer varies with the stage of growth at which the fertilizer is applied. Application in the early stages increases the production of tillers, whilst application at a later stage tends to increase the number of grains set in each ear. Extra tillers are useless unless formed early in the season, for late-formed tillers do not usually carry ears at harvest. In practice this means that spring applications of nitrogenous fertilizer cannot be relied upon to give a substantial increase in the *number* of ears, but if applied at the right time they will often increase the *size* of the ears. Applied at the wrong time, a considerable part of a spring top dressing only serves to produce useless tillers and to increase the amount of straw, thereby rendering the crop more liable to "lodge."

It is often best, therefore, to delay the spring top dressing until tiller production has practically ceased. For wheat crops that have wintered badly, or require to be stimulated to grow away from some pest or disease, a nitrogenous top dressing in February or March may be imperative. On the other hand, where the crop has wintered satisfactorily, late April to mid-May now seems likely to be the best time, though the efficiency of this late dressing is dependent on a reasonable amount of rain in later months so that the crop can utilize the added nitrogen. If the suggested delay in the time of application seems contrary to local requirements or local practice the matter should be discussed with the County Organizer. Investigations have shown quite clearly that in suitable circumstances a top dressing at the right time can be a very profitable investment.

Spring Barley. As long as nitrogenous fertilizer is not used in such large quantities as to cause the crop to "lodge" it is not likely to have any serious effect on the market value of the wheat grain. Malting barley, however, presents a different problem. The practical application of the principle that floury grain and low nitrogen content usually go hand in

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hand is to be found in the importance that growers attach to the correct manuring of the barley crop. Indeed, the tendency on some farms has been to over-emphasize the risks involved in the use of nitrogenous fertilizer for barley, with the result that yields have sometimes suffered through too severe restriction of supplies of nitrogen.

In a recent paper* Dr. Hunter, of the Cambridge Plant Breeding Institute, discussed the question of nitrogen content of the grain from the standpoint of the plant breeder and suggested that a high tiller-survival rate may be an index of low nitrogen content. In an attempt further to elucidate this problem, especially in relation to supplies of nitrogen in the soil, Dr. Hunter has carried out experiments on the variety Spratt Archer, varying the time of application of a dressing of 1 cwt. per acre of nitrate of soda from seeding time on some plots to as late as 3 weeks after flowering (or 15½ weeks after seeding) on others.

Plots that received nitrate of soda before the tillers assumed an erect position (approximately 9½ weeks after seeding, or 10½ weeks before harvest) all showed a definite increase in the yield of grain and in the number of surviving tillers, but no increase in the percentage of nitrogen in the grain. Plots that received later dressings of nitrogen showed little or no increase in the yield of grain or in the number of surviving tillers, but a very marked increase in the percentage of nitrogen in the grain. In other words, an increase in the number of surviving tillers was associated with an increase in the yield of grain, but not with any increase in the percentage of nitrogen in the grain.

It should be noted in passing, that although the dressings of nitrate of soda applied towards the end of the first half of the growing season did not increase the percentage of nitrogen in the grain, they did apparently lead to the survival of a number of small tillers that bore only small grain—a point of importance in considering the uniformity of the resulting samples of grain.

The influence of tiller survival on the percentage of nitrogen in the grain, as well as on the yield of grain, was further demonstrated by plots on which the number of tillers per plant was artificially controlled—tillers being cut down (and kept cut) on different plots at different stages in the growth of the

* C.R. Ve V^{me}. Congr. Int. Techn. Chim. Industr. Agric. Scheveningue, 1937 (Sect. 4).

NOTES ON MANURING

plant. The removal of tillers resulted in a high percentage of nitrogen in the grain from the surviving tillers. Hence, as with the wheat crop, the effect of nitrogen on the growth of barley may be manifested in either of two ways according to the physiological stage in the life of the plant at which it becomes operative. Nitrogen available to the plant between seeding and the time when the tillers become erect tends to increase the number of ear-bearing tillers and hence the yield of grain, but used in moderate amounts does not increase the percentage of nitrogen in the grain. Nitrogen available later in the season does not affect tiller survival, for tillering has almost ceased, but finds its way into the grain, which, though it may be increased in size, will also usually exhibit a high nitrogen percentage and lower malting quality.

Soils rich in organic matter or well supplied with dung or other slowly-decomposing organic matter, liberate nitrogen to the plant not merely during the early part of the growing season, but also during the post-flowering period, and any excess nitrogen in the latter period will tend to pass into the grain, thereby increasing its nitrogen content.

To the farmer, however, the matter is not confined solely to quality or value per quarter, but rather to value per acre. Hence, yield per acre and the possibility of nitrogen, whether from organic or inorganic sources, increasing the yield, is important, especially if with increasing knowledge of the effect of nitrogen on the development of the plant, he is able to utilize nitrogen in such a way that yields are increased without serious detriment to quality.

There is no evidence to suggest that any advantage may accrue from the application of nitrogenous fertilizer to barley as an early top dressing rather than on the seedbed. Indeed, in view of the harmful effects from the presence of excessive supplies of nitrogen in the soil late in the growing season, it seems that application not later than seeding time is by far the safest. Where the condition of a young crop seems to warrant it, however, a small top dressing can be given without undue risk of serious injury to the quality of the grain, provided it is applied as soon as the need for it becomes apparent, and at any rate in time for the nitrogen to take effect before the tillers begin to assume an erect position. To encourage quick action any such emergency top dressing should supply the nitrogen in the form of nitrate, e.g., nitrate of soda, nitrate of lime or nitro-chalk.

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One-year "Seeds" Leys. A "seeds" ley frequently has to put up with whatever treatment is deemed best for the nurse crop. Nevertheless a "seeds" ley is often grown, partly at any rate, for its value in helping to maintain the fertility of the soil, and not solely for the hay crop it produces, and from this standpoint a good proportion of clover is very desirable, even in a one-year ley. There is no doubt about the value of a good dressing of basic slag on the seedbed of a three- or four-year ley, and phosphate is equally important for one-year leys.

For the sake of the nurse crop it is not desirable to encourage too much clover, but on many farms complaint is made that the leys are regularly short of clover, and it is not always possible to attribute the failure to genuine clover sickness. On light soils, to help the clover in a "seeds" ley, it is just as essential to give potash as phosphate, and even if there is no likelihood of the nurse crop deriving benefit from potash, 1 cwt. per acre of muriate of potash may make all the difference between a ley containing a good proportion of clover and one consisting almost entirely of rye-grass. The potash should be worked into the soil when preparing the seedbed for the nurse crop.

A good ley should not need any fertilizer in the spring of its harvest year. Where very little clover survives the winter, however, though it is too late to do anything to increase the clover, it may be worth while giving a top dressing of about 1 cwt. per acre of nitrogenous fertilizer to encourage the rye-grass, especially where as much hay as possible is required for winter keep.

Injection Methods for the Diagnosis of Nutrient Deficiencies. Though a plant or tree is known to be suffering from a lack of some particular element of plant food, the application to the soil of a substance containing the missing element does not always result in its immediate recovery. This difficulty is often encountered with fruit trees and has led to the trial of other methods of getting a tree to assimilate elements of plant food. Of the methods tried, the injection of a solution containing the missing element into the tree itself has often proved successful. An interesting point about this injection treatment is that, in some circumstances, injection methods can also be used as a means of ascertaining from what deficiency a tree is suffering. Quick and accurate diagnosis of the cause of unsatisfactory plant growth is often difficult. This,

NOTES ON MANURING

is particularly so with the many different troubles that result in the development of a yellowish colour in the foliage. Many factors may cause yellowing of foliage, and these include such widely different troubles as waterlogging, nitrogen starvation, iron deficiency and some virus diseases. Careful examination of the tree or plant enables some of these to be distinguished from others, but frequently the distinction is not easy. Chemical analysis of soil or plant may indicate probable deficiencies, but often such analyses provide no satisfactory clue.

Investigations by W. A. Roach and his colleagues at the East Malling Research Station have now shown that it is possible to diagnose some of these troubles by injection methods. Dilute solutions of substances containing elements that may be required are injected into the tree or plant, thereby ensuring that they do enter the plant and also shortening the time required for their effects to become visible. To overcome the difficulty of detecting a small change in the general colour of a large plant or tree the injection can be confined to a single shoot, a single leaf, or even a single interveinal area of a leaf. In the last method the injected area is compared with other areas on either side of it. Even a secondary vein is apparently sufficient to prevent the rapid spread of the influence of the injected solution to the rest of the leaf. This method ensures that the control and treated areas are as nearly as possible identical, not only in colour, but in other features, such as texture, and being so close to one another the two areas can be compared with ease and accuracy. Thus much smaller changes can be detected than where the comparison is between different leaves or different trees.

The rapidity of the method in suitable circumstances is shown by the fact that in one instance iron shortage was detected in less than a week.*

Much remains to be discovered on such points as the mineral deficiencies and the plants for which leaf injection can be used. There is already some evidence that it is not suitable for all types of leaves, e.g., it is said to have been used successfully with the foliage of apple trees and strawberries, but was not successful with tomato leaves. So far most attention has been directed to its use for detecting iron deficiency, but further experiments using the common nutrient elements are said to be in progress at East Malling.

The results will be of considerable interest.

* East Malling Report for 1936.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton (2,240 lb.) during week ended Feb. 16				
	Bristol	Hull	L'pool	London	Costs per Unit†
Nitrate of Soda (N. 15½%) ..	£ 8 0c	£ 8 0c	£ 8 0c	£ 8 0c	10 4
" " Granulated (N. 16%) ..	8 0c	8 0c	8 0c	8 0c	10 0
Nitrate of Lime (N. 13%) ..	7 7½	7 7½	7 7½	7 7½	11 4
Nitro-Chalk (N. 15½%) ..	7 10c	7 10c	7 10c	7 10c	9 9
Sulphate of Ammonia:—					
Neutral (N. 20·6%) ..	7 12c	7 12c	7 12c	7 12c	7 5
Calcium Cyanamide (N. 20·6%)	7 14d	7 14d	7 14d	7 14d	7 6
Kainite (Pot. 14%) ..	2 18	2 15	2 15	2 15	3 11
Potash Salts (Pot. 30%) ..	5 4	5 1	5 0	5 1	3 5
" " (Pot. 20%) ..	3 15	3 12	3 12	3 12	3 7
Muriate of Potash (Pot. 50%)	8 10	8 8	8 5	8 8	3 4
Sulphate (Pot. 48%)	10 2	10 0	9 17	10 0	4 2
Basic Slag (P.A. 15½%) ..	2 12b	2 5b	—	2 10b	3 2
" " (P.A. 14%) ..	2 8b	2 0b	2 0b	2 6b	3 3
Grd. Rock Phosphate (P.A. 26-27½%) ..	3 7a	3 2a	2 18a	2 12a	2 0
Superphosphate (S.P.A. 16%)	3 4	—	3 5f	3 0g	3 9
" " (S.P.A. 13½%)	3 1	2 17	3 2f	2 16g	4 1
Bone Meal (N. 3½%, P.A. 20½%)	—	7 5	7 5h	7 2	—
Steamed Bone Flour (N. ½%, P.A. 27½-29½%) ..	5 5i	5 10	4 17h	4 11	—

Abbreviations: N. = Nitrogen; P.A. = Phosphoric Acid;
S.P.A. = Soluble Phosphoric Acid; Pot. = Potash.

* Prices are for not less than 6-ton lots, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage-paid prices.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. prices.

a Prices for 4-ton lots f.o.r. Fineness 85% through standard sieve.

b Prices for 6-ton lots. Prices at Bristol are f.o.r. Bridgwater; at Hull and Liverpool f.o.r. neighbouring works, and at London f.o.r. at depots in London district. Fineness 80% through standard sieve.

c For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, and for lots of 1 ton and under 2 tons, 10s. extra.

d Delivered in 5-ton lots at purchaser's nearest railway station. For lots of 2 tons and under 5 tons the price is 5s. per ton extra, for lots of 1 ton and under 2 tons, 10s. per ton extra, and for lots of 4 cwt. and under 1 ton, 20s. extra.

e For lots of 4 tons and under 6 tons the price is 1s. per ton extra, for lots of 2 tons and under 4 tons, 5s. per ton extra, for lots of 1 ton and under 2 tons 7s. 6d. per ton extra, and for lots of under 1 ton, 20s. extra.

f Prices shown are f.o.r. Widnes.

g Prices shown are f.o.r. northern rails; southern rails, 1s. 3d. extra.

h Prices shown are f.o.r. Appley Bridge.

i Price shown is f.o.r. Newport, Mon.

† These are calculated by regarding a ton as comprising 100 "units" (equal parts of 22·4 lb.) so that a fertilizer, for example, with 16 per cent. nitrogen, contains 16 such "units" in a ton. Then, if the price per ton of such a fertilizer be divided by the percentage figure, the deduced cost is that of a "unit" of that agent. Those in the table above are based on London prices. (For further explanation, see Advisory Leaflet No. 146, "The Valuation of Artificial Manures," obtainable from the Ministry, free of charge.)

NOTES ON FEEDING

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Use of Milk and Milk Products in Pig Feeding. The great increase in the demand for milk for human consumption, occasioned by the rapid growth of the population during the nineteenth and early twentieth century, coupled with improvement of transport, has largely restricted the utilization of whole milk on the farm to the minimum requirements for calf-rearing. For other purposes it is now commonly regarded as too expensive, except perhaps when surplus to the requirements of the liquid milk market.

It should not be too readily assumed, however, that the use of milk is necessarily uneconomic because the food value of milk, when assessed in terms of the protein, fat and carbohydrate it supplies, usually compares very unfavourably in terms of cost with that of alternative feeding-stuffs. Modern research has demonstrated that milk as a food may possess virtues that are not assessable in terms of the above ingredients, and that its use along with other foodstuffs may enhance the nutritive effects obtainable from the latter. Some factors in milk that may contribute to this special effect are known, such as its content of vitamins, the high "quality" of its proteins, and the nice balance of its mineral ingredients. All these may play a part, but there are doubtless other factors, as yet unknown, that contribute to place milk in a position apart from all other feeding-stuffs.

These special properties of milk are retained to some extent in the by-products arising from it, such as separated milk, buttermilk and whey, certainly in the liquid forms, and to a less degree in the dried forms. This has always been clearly recognized in connexion with pig-feeding, which is traditionally associated with dairying, and in the minds of many older farmers can still only be practised with profit when so associated. That this view is exaggerated is obvious from the fact that so much of our pig-feeding to-day is carried on successfully by the use of "milk substitutes," such as fish meal and meat meal, which when properly used give results in rate of growth almost, if not quite, equal to those obtainable with milk. It is still probably true, however, that milk (or skim milk) if available at a suitable cost, is the best of all supplements to the cereal meals for pig feeding, and a

NOTES ON FEEDING

summary of evidence from experimental work may be helpful in forming an estimate of its possibilities under present conditions.

Whole Milk, and Separated Milk. The striking improvement in growth rate that can be affected by the addition of even very small quantities of whole milk to a cereal meal diet was exemplified in experiments at Shinfield some ten years ago, when in each of six separate comparisons the addition of only half a pint of whole milk per head daily to the ration increased the growth rate of the pigs by about 10 per cent. The further improvement that is possible when more milk is used may be illustrated by the results of a comparison made at the Harper Adams College, in which by the use of 4 pints of whole milk per head daily the growth rate was increased by no less than 42 per cent. as compared with that of similar pigs receiving the same cereal meals (plus minerals) but no milk. Included in this experiment was also a third lot receiving meals and 4 pints daily of separated milk, and here the improvement in growth rate was about 26 per cent. Whole milk thus proved markedly superior to the separated milk in its effect upon rate of growth, but the difference was found to represent in fact a very poor return for the butterfat fed in the whole milk, as compared with what might have been obtained if the cream had been removed and sold as such or made into butter.

The conclusion that the feeding of whole milk to pigs is uneconomic as compared with the use of separated milk has also been confirmed by Norwegian experiments. The two sets of experiments also agree in indicating that in its effect upon growth rate whole milk has only about $1\frac{1}{2}$ times the value of separated milk, and not double the value as is commonly assumed on the basis of the old Danish feeding experiments upon which the Scandinavian table of food unit values is based.

The one place in the feeding scheme where whole milk can probably be used to advantage, both physiological and economic, in comparison with separated milk, is in the period before and just after weaning, say up to about 45 lb. live-weight. Thereafter the balance of economy, as between the two forms of milk, changes rapidly in favour of separated.

The difference of effect between whole milk and separated milk is largely one of degree, and the following observations,

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although concerned specifically with the use of separated milk, would probably apply also in principle to whole milk.

The return obtainable from separated milk through the pig will vary with the rate at which it is fed and the stage of growth of the pig at which it is used. Broadly speaking, the return per gallon will be the greater the smaller the daily allowance and the younger the pig. Thus in one of the Harper Adams experiments in 1930 the returns per gallon of separated milk, under the price conditions then prevailing, were estimated to be as under:—

When given at the rate of 4 pints per head daily	..	2.8d.
" " " 2 " "	..	3.4d.
" " " 1 " "	..	4.7d.

In another experiment with pigs weighing initially about 50 lb. each the profit from the use of separated milk was greatest in the first six weeks and least in the last six weeks of the feeding period.

In farm practice the allowance will be determined by the amount of milk and the number of pigs available, but it is clearly a sound economic policy to spread the milk over as many pigs as possible, giving preference, if necessary, to younger over older pigs.

On the question of the optimum ratio between meal and milk, guidance is available from Scandinavian reports based upon large numbers of observations. In a Swedish report (1925) that reviews the results of 23 experiments involving the use of more than 400 pigs, the conclusion is drawn that the full value of the separated milk is only realized if the daily allowance of milk does not exceed about one-third of the total nutritive value of the daily ration. (The same was also found to apply with whey feeding.) Undiluted buttermilk was found to be practically equal to separated milk in feeding value.

In a more recent Danish report (1930) the average results given below were obtained in extensive comparisons of various ratios of separated milk to meals (mixed maize and barley):—

Group	1 lb. Milk per 1 lb. Meal	Daily Gain in Live-weight lb.	Daily Gain Group 1 = 1.00 lb.
1 ..	0.0	0.53	1.00
2 ..	0.5	1.04	1.96
3 ..	1.0	1.31	2.47*
4 ..	1.5	1.55	2.92
5 ..	2.0	1.56	2.94

* In an experiment at Harper Adams College in 1923, the corresponding figure for the use of separated milk with mixed barley and oats at the rate of 1 lb. milk per 1 lb. meal was 2.36.

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It will be noted that the first 0.5 lb. of milk (per 1 lb. of meal) practically doubled the rate of growth, and that although the effects of successive increases of milk supply steadily grew less they were considerable up to a supply of 1.5 lb. of milk per 1 lb. of meal. At this point the deficiencies of the cereal diet have apparently been remedied by the milk, and little further specific advantage is to be gained by increasing the proportion. These are average figures for the whole feeding period, however, and probably it would be better in practice to use the milk rather more liberally in the earlier stages, reducing the proportion of milk to meal gradually as the pig grows.

It should be observed that the meals used in the above experiments were plain cereal mixtures, and it is only with such mixtures that a large response is to be expected from the use of milk. Theoretically a "balanced mixture" should be complete in itself, its cereal ingredients having been "balanced" by the admixture of a milk substitute such as fish meal. In the present state of knowledge of food requirements, however, a perfect balance is only attainable by accident, and it is possible that even with a mixture that is regarded as "balanced" some further small improvement in results may be obtained by the use of milk. It is more likely, however, that this will involve an excessive supply of protein, and the safer, cheaper and more sensible plan where a supply of separated milk is available is to remove the "milk substitute" partly or entirely from the ration.

There is some evidence that when separated milk is used as the protein supplement it is possible to work profitably to a higher level of protein supply than with the ordinary balanced mixtures fed with water. Thus in one of the Harper Adams experiments (1932) the maximum average growth rate obtained when using soya-bean meal as protein concentrate was 1.23 lb. per head per day; with the same amount of digestible protein given as liquid separated milk it was 1.30 lb., whilst with $1\frac{1}{2}$ times the amount of protein given as separated milk it was raised to 1.37 lb. per day. This is also in accord with the observation that the standards of effective protein supply arrived at in this country from experiments in which the pigs were given meals and water are slightly lower than the Scandinavian standards which are based upon milk feeding.

Regarding the use of milk for pigs, one point of detail that

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is often raised is whether the degree of sourness of the milk is a matter of any practical consequence. On this point the evidence of the Swedish experiments referred to above was that souring seemed to lower the value of separated milk slightly, but where the milk must of necessity be given sour, it appeared to do best when completely sour, that is, to the point of curdling. The quantity given is perhaps a decisive factor in this connexion, and if this is no more than 2 to 4 pints per head the degree of sourness is probably of little or no importance, especially if about 1 per cent. of carbonate of lime is given with it.

Whey. Pig-feeding is traditionally associated with cheese-making, but despite long years of experience the views held in practical circles as to the feeding value of the whey are curiously diverse. This doubtless arises from the ease with which disappointing results may ensue if whey is used improperly. Judged by chemical composition the whey "solids" bear a close resemblance to the low-fibrous cereal meals in being rich in carbohydrates and relatively poor in protein, but differ in that the carbohydrate in whey is milk sugar, while the minerals of the whey are better "balanced" than those of cereals. The presence of a little lactic acid in whey is also often claimed to be of advantage. Whey differs chiefly from separated milk in its comparative poverty in protein, and in this respect can obviously not serve as a substitute for the milk. The chief practical disadvantage of whey is the high proportion of water to solids (about 14 : 1). This can, however, be reduced to a suitable proportion in the total ration if about $3\frac{1}{2}$ lb. of dry meal be given with each gallon of whey. On this basis a suitable allowance of whey would range from about half a gallon per head daily for small pigs up to 2 gallons for big pigs. Whey can be fed more freely than this if desired, but only at the risk of undue laxativeness and the certainty of very wet floors. The Swedish experiments indicated the maximum amount desirable to be about $2\frac{1}{2}$ to 3 gallons, or not more than about one-third of the total food value of the ration. Practical experience indicates that whey should be fed sparingly to young pigs until they reach the live-weight of 80-90 lb., and again later the amount should be reduced for the last two or three weeks before slaughter.

That whey when used properly and in moderation is a

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valuable supplement to cereal meals for the pig is undoubted. In the Scandinavian "food unit" table it is credited with one-half of the value of separated milk, and this was roughly confirmed in the test made at Harper Adams College in 1923 to which reference has already been made.

Dried Milk Products. If the drying of separated milk, buttermilk and whey were no more than a removal of water, there would be no obvious reason why the dried products should not retain the full nutritive properties of the original liquid forms, including those special virtues that would justify higher prices than those of competitive milk substitutes. The balance of evidence from pig-feeding experiments so far, however, has provided little support for this view. Thus in Canadian experiments in 1931 skim milk powder was only 2.9 per cent. more efficient for producing liveweight gain than a special protein-mineral mixture with which it was compared. In two experiments at Harper Adams College no advantage has been found from replacing extracted soya-bean meal by an equal weight of dried separated milk. Similarly in a Scottish test in 1935 the results obtained with dried skim milk were inferior to those given with liquid skim milk.

Experience has been much the same also in tests of dried whey. These have rarely given warrant for any claim to special virtue for the dried whey beyond what its content of proteins, fats and carbohydrates would lead one to anticipate.

In short, these dried products, whilst excellent, and probably the most efficient in their class, do not appear to be equal to the liquid forms from which they are made, and, except possibly for the earliest stages of rearing, do not display that measure of superiority over competitive feeding stuffs that is required to neutralize their disadvantage in cost.

Space will not permit of discussion of the influence of milk and milk products upon the quality of the pig's carcass, and the general observation must suffice that this effect is beneficial, both as to carcass percentage and quality of fat, provided the amounts of milk or whey used are not excessive. The improvement is usually obvious in the appearance of the live animal.

PRICES OF FEEDING STUFFS

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British ..	8 7	0 9	7 18	72	2 2	1·16	9·6
Barley, British feeding	9 0½	0 9	8 11	71	2 5	1·29	6·2
" Canadian, No. 3							
Western ..	9 0	0 9	8 11	71	2 5	1·29	6·2
" Argentine ..	9 0½	0 9	8 11	71	2 5	1·29	6·2
" American ..	8 10½	0 9	8 1	71	2 3	1·21	6·2
" Persian ..	8 13½	0 9	8 4	71	2 4	1·25	6·2
" Russian ..	9 0*	0 9	8 11	71	2 5	1·29	6·2
Oats, English, white ..	9 0	0 10	8 10	60	2 10	1 52	7·6
" " black and grey	8 13	0 10	8 3	60	2 9	1·47	7·6
" Scotch, white ..	9 3	0 10	8 13	60	2 11	1·56	7·6
" Canadian, No. 2							
Western ..	10 13*	0 10	10 3	60	3 5	1·83	7·6
" Canadian, mixed feed ..	8 10	0 10	8 0	60	2 8	1·43	7·6
" Canadian, No. 1 feed ..	8 15½	0 10	8 5	60	2 9	1·47	7·6
Maize, American ..	7 5	0 7	6 18	78	1 9	0·94	7·6
" Argentine ..	7 18	0 7	7 11	78	1 11	1·03	7·6
" South African, No. 2, white	7 10½	0 7	7 3	78	1 10	0·98	7·6
Beans, English, Winter	8 0½	0 18	7 2	66	2 2	1·16	19·7
Peas, English, blue ..	12 10½	0 15	11 15	69	3 5	1·83	18·1
" Japanese ..	21 10½	0 15	20 15	69	6 0	3·21	18·1
Mulling Offals—							
Bran, British ..	8 2	0 17	7 5	43	3 4	1·79	9·9
" broad ..	8 12	0 17	7 15	43	3 7	1·92	10·0
Middlings, fine imported ..	8 7	0 14	7 13	69	2 3	1·21	12·1
Weatings† ..	8 10	0 15	7 15	56	2 9	1·47	10·7
" Superfine†	8 17	0 14	8 3	69	2 4	1·25	12·1
Pollards, imported ..	8 2	0 15	7 7	50	2 11	1·56	11·0
Meal, barley ..	10 0	0 9	9 11	71	2 8	1·43	6·2
" " grade II ..	9 5	0 9	8 16	71	2 6	1·34	6·2
" maize ..	8 12	0 7	8 5	78	2 1	1·12	7·6
" " South African	7 15	0 7	7 8	78	1 11	1·03	7·6
" " germ ..	8 15	0 11	8 4	84	1 11	1·03	10·3
" locust bean ..	7 15	0 6	7 9	71	2 1	1·12	3·6
" bean ..	9 7	0 18	8 9	66	2 7	1·38	19·7
" fish (white) ..	15 0	2 6	12 14	59	4 4	2·32	53·0
" Soya bean (extracted)† ..	9 5	1 11	7 14	64	2 5	1·29	38·3
Maize, cooked, flaked	9 0	0 7	8 13	84	2 1	1·12	9·2
Linseed cake—							
English, 12% oil ..	10 17	1 1	9 16	74	2 8	1·43	24·6
" 9% " ..	10 5	1 1	9 4	74	2 6	1·34	24·6
" 8% " ..	10 0	1 1	8 19	74	2 5	1·29	24·6

PRICES OF FEEDING STUFFS (continued)

Description	Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
Cottonseed cake, English, Egyptian seed, 4½% oil ..	£ s. 5 10	£ s. 0 19	£ s. 4 11	42	s. d. 2 2	d. 1 16	% 17·3
Cottonseed cake, Egyptian, 4½% oil ..	5 5	0 19	4 6	42	2 1	1·12	17·3
Cottonseed cake, decorticated, 7-8% oil	8 0†	1 10	6 10	68	1 11	1·03	34·7
Cottonseed meal, decorticated, 7-8% oil	8 5†	1 10	6 15	70	1 11	1·03	36·8
Coconut cake, 5% oil	7 15†	0 19	6 16	77	1 9	0·94	16·4
Ground nut cake, 6-7% oil	7 0*	1 0	6 0	57	2 1	1·12	27·3
Ground nut cake, decorticated, 6-7% oil	8 12*	1 9	7 3	73	2 0	1·07	41·3
Ground nut cake, imported decorticated, 6-7% oil	7 12	1 9	6 3	73	1 8	0·89	41·3
Palm-kernel cake, 4½-5½% oil	7 10†	0 13	6 17	73	1 11	1·03	16·9
Palm-kernel cake meal, 4½% oil	7 15†	0 13	7 2	73	1 11	1·03	16·9
Palm-kernel meal, 1-2% oil	6 17	0 13	6 4	71	1 9	0·94	16·5
Feeding treacle	5 0	0 8	4 12	51	1 10	0·98	2·7
Brewers' grains, dried ale	6 12	0 12	6 0	48	2 6	1·34	12·5
" " " porter	6 5	0 12	5 13	48	2 4	1·25	12·5
Dried sugar-beet pulp							

From £6 os. od. to £6 15s. od. per ton ex-factory
(according to factory)

* At Bristol. § At Hull. † At Liverpool.

‡ In these instances manurial value, starch equivalent and protein equivalent are provisional.

NOTE : The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the beginning of February, 1938, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if linseed cake is offered locally at £11 per ton, then since its manurial value is £1 1s. per ton as shown above, the cost of food value per ton is £9 19s. Dividing this figure by 74, the starch equivalent of linseed cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in one unit, the cost per lb. of starch equivalent is 1.43d. Similar calculations will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N, 7s. 7d.; P₂O₅, 2s. 7d.; K₂O, 3s. 8d.

FARM VALUES OF FEEDING STUFFS

The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	<i>Starch equivalent Per cent.</i>	<i>Protein equivalent Per cent.</i>	<i>Per ton £ s.</i>
Barley (imported)	71	6·2	8 17
Maize	78	7·6	7 18
Decorticated ground-nut cake	73	41·3	8 2
" cotton-seed cake	68	34·7	8 0

(Add ros. per ton, in each instance, for carriage.)

The cost per unit starch equivalent works out at 2·37 shillings, and per unit protein equivalent 0·10 shilling. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values," which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows, are given in the November, 1936, issue of the Ministry's JOURNAL, p. 816.)

FARM VALUES

Crop	Starch equivalent Per cent.	Protein equivalent Per cent.	Food Value per ton, on farm £ s.
Wheat	72	9·6	8 12
Oats	60	7·6	7 3
Barley	71	6·2	8 9
Potatoes	18	0·8	2 3
Swedes	7	0·7	0 17
Mangolds	7	0·4	0 17
Beans	66	19·7	7 18
Good meadow hay	37	4·6	4 8
Good oat straw	20	0·9	2 7
Good clover hay	38	7·0	4 11
Vetch and oat silage	13	1·6	1 11
Barley straw	23	0·7	2 15
Wheat straw	13	0·1	1 11
Bean straw	23	1·7	2 15

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, price 6d., post free 7d.

MISCELLANEOUS NOTES

The Agricultural Index Number

The general index number of prices of agricultural produce for January is 134 (base, January, 1911-13=100) or two points higher than a month ago and 4 points above that recorded for January, 1937. If allowance be made for payments under the Wheat Act, 1932, and the Livestock Industry Act, 1937, the revised index for the month becomes 138. Compared with December, the average prices of oats, fat cattle and poultry advanced; while those of wheat, fat sheep and pigs, eggs and butter declined.

Monthly index numbers of prices of Agricultural Produce. (Corresponding months of 1911-13 = 100.)

Month	1933	1934	1935	1936	1937	1938
January	107	114	117	119	130	134
February	106	112	115	118	129	—
March	102	108	112	116	130	—
April	105	111	119	123	140	—
May	102	112	111	115	133	—
June	100	110	111	116	131	—
July	101	114	114	117	131	—
August	105	119	113	119	133	—
September	107	119	120	127	137	—
October	107	114	113	125	131	—
November	109	114	113	125	133	—
December	110	113	114	126	132	—

Revised monthly index numbers of prices of Agricultural Produce, allowing for payments under the Wheat Act (a) and for the Cattle subsidy (b).

Month	1933	1934	1935	1936	1937	1938
January	111	119	124	125	133	138
February	110	117	122	123	133	—
March	106	112	118	122	134	—
April	109	116	126	128	143	—
May	105	116	117	120	136	—
June	104	114	117	121	134	—
July	104	117	120	121	134	—
August	108	122	120	124	136	—
September	111	125	128	133	142	—
October	112	121	119	129	134	—
November	113	120	119	129	137	—
December	114	120	120	130	136	—

(a) Commenced August, 1932.

(b) Commenced September, 1934.

MISCELLANEOUS NOTES

In the following table the monthly index numbers of prices of individual commodities are shown for the months of October, 1937, to January, 1938, January, 1937, and January, 1936; base, the corresponding months of 1911-13 = 100.

Commodity	1938	1937			1937	1936
	Jan.	Dec.	Nov.	Oct.	Jan.	Jan.
Wheat	114	116	120	124	133	85
Barley	165	160	152	148	125	101
Oats	124	119	120	124	120	87
Fat cattle	123	113	113	111	97	97
„ sheep	133	131	137	134	140	127
Bacon pigs	134	131	129	124	130	107
Pork „	140	139	137	131	131	115
Eggs	120	121	126	136	95	115
Poultry	133	130	132	133	120	127
Milk	181	181	181	171	171	171
Butter	105	110	116	111	95	93
Cheese	125	120	121	122	107	93
Potatoes	142	152	156	153	205	201
Hay	77	79	79	86	98	83
Wool	122	117	133	140	131	96
Dairy cows	123	121	119	120	111	105
Store cattle	119	112	107	111	99	94
„ sheep	113	112	116	129	118	105
„ pigs	164	159	167	164	152	134

Revised index numbers due to payments under the Wheat Act and to the Cattle subsidy.

Wheat	135	135	132	134	135	124
Fat cattle	138	127	128	126	112	111
General Index	138	136	137	134	133	125

Grain. Wheat, at an average of 8s. 4d. per cwt., was 2d. lower on the month and the index declines by 2 points. If the deficiency payment under the Wheat Act, 1932, is taken into account the index is 135. Barley was unchanged at 13s. 2d. per cwt., but, owing to a fall in the base price, the index advances by 5 points. At 8s. 6d. per cwt. oats realized 2d. per cwt. more than a month ago and the index moves upwards by 5 points. In January, 1937, wheat averaged 9s. 9d., barley 10s. and oats 8s. 2d. per cwt.

Live Stock. Quotations for fat cattle continued to appreciate during January; second quality averaging 41s. 11d. per live cwt. compared with 40s. 4d. the previous month, and the index rises by 10 points to 123. If the subsidy under the Livestock

MISCELLANEOUS NOTES

Industry Act, 1937, is added, the index becomes 138. Fat sheep at 10d. per lb. for second quality averaged $\frac{1}{2}$ d. less than in December, but, as the fall was proportionately more in the base period the index is higher by two points. Baconers at 12s. 9d. and porkers at 14s. 6d. per score (20 lb.) were reduced in price by 4d. and 7d. respectively. During the months of January, 1911-13, however, price movements, although similar, were relatively greater and the indices move upwards by 3 points and 1 point respectively.

Prices of dairy cows and store pigs declined during the month under review, but a proportionately larger reduction having been recorded in the base prices, the index for the former rises by two points and for the latter by 5 points. Store cattle and sheep were dearer as compared with December, the relative indices appreciating by 7 points and 1 point.

Dairy and Poultry Produce. The regional price of liquid milk was again unchanged and the index continues at 181. Butter at 1s. 3 $\frac{1}{2}$ d. per lb. was lower by 1d. per lb., the index falling by 5 points. Eggs at 15s. 5d. per 120 were reduced by 5s. and the index is 1 point lower. Cheese averaged £4 11s. per cwt., the same as a month ago, but, with a fall in the base period, the current index advances by 5 points. Quotations for poultry moved upwards, as a rule, and the combined index is 3 points higher.

Other Commodities. Potatoes at £5 8s. 6d. per ton, and clover and meadow hay at £3 18s. 6d. and £2 16s. per ton respectively, were unaltered in price, but, owing to increases which took place during the corresponding months of 1911-13, the index for potatoes is 10 points and the combined index for hay 2 points lower. At 1s. 3 $\frac{1}{2}$ d. per lb. the December average price of wool was repeated, but the index shows an advance of 5 points.

Index Numbers of Agricultural Prices

A new series of price indices of agricultural commodities designed to replace the existing series is in course of preparation. The new series will be related to a new base period; the general price index of agricultural produce and those for groups of commodities will be computed on a different weighting system; additional indices will be calculated where applicable to show both actual price changes and price changes due to causes other than normal seasonal variation; and sundry other revisions will be introduced in the case of

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certain products relating to the selection of prices and their averaging, and the methods of eliminating seasonal variation.

The new series will, it is anticipated, be introduced next month, but as revised indices for the last 10 years are also being prepared the substitution will, in effect, date back to 1927. A full description of the new indices, with tables showing comparisons with the existing series, will be issued as a separate publication.

Agricultural Scholarships

The Ministry invites applications for the undermentioned scholarships which are being offered for award this year under the scheme of scholarships for the sons and daughters of agricultural workmen and others:—

Ten Senior Scholarships, tenable at Agricultural Colleges or University Departments of Agriculture, for diploma or degree courses in an agricultural subject, or at Veterinary Colleges for courses in veterinary science;

Ten Extended Junior Scholarships (for those who have already held Junior Awards), and *120 Junior Scholarships*, tenable at Farm Institutes or similar institutions, for courses not exceeding a year in duration, in agriculture, horticulture, dairying, or poultry husbandry.

The scholarships are open to the sons and daughters of agricultural workmen or of working bailiffs, smallholders and other rural workers whose means and method of livelihood are comparable with those of agricultural workmen, and to persons who are themselves *bona fide* workers in agriculture. The value of the awards is such that neither the recipients nor their parents are normally required to make any contribution towards the cost of the training provided. The usual method of selection is by interview, no written examination being required, but candidates must be able to satisfy the Selection Committee that they are in a position to derive educational benefit from the proposed courses of instruction and must also intend to follow an agricultural pursuit on completion of their training.

Full information concerning the scheme, including forms of application and a leaflet outlining the types of career open to students who have completed courses of training, may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1, or locally from the offices of County Councils. The latest date for submitting applications is April 30, 1938.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATIONAL STAFFS: ENGLAND

Berkshire : Miss F. J. Atkinson, N.D.D., has been appointed Assistant Instructress in Dairying.

Buckinghamshire : Mr. F. W. Webb has been appointed Assistant Adviser in Horticulture, *vice* Mr. J. N. Acaster.

Oxford : Mr. J. Harrison, B.Sc. (Agric.), has been appointed Instructor in Agriculture.

WALES

Brecon and Radnor. Miss D. J. Corfield, N.D.D., has been appointed Instructress in Dairying, and Miss J. T. Cock, N.D.P., as Instructress in Poultry-keeping, *vice* Miss E. Jones, N.D.D., Instructress in Dairying and Poultry-keeping, resigned.

MINIMUM RATES OF WAGES

Enforcement of Minimum Rates of Wages. During the month ending February 12, 1938, legal proceedings were taken against seven employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases follow :—

Committee Area	Court	Fines Imposed	Costs Allowed	Arrears of Wages ordered	No. of workers involved
Cheshire ..	Congleton	£ s. d. 6 0 0	£ s. d. 0 16 0	£ s. d. 67 0 0	2
Glamorgan	Bridgend	(A)	3 3 0	5 0 0	1
Glamorgan	Gowerton	2 0 0	—	13 19 9	1
Lancashire	Liverpool	5 0 0	—	60 0 0	1
Pembroke ..	Narberth	7 10 0	—	28 17 2	1
Worcester ..	Tenbury ..	1 0 0	0 2 6	26 10 2	1
Yorks (W.R.)	Dewsbury	2 0 0	0 5 0	23 14 0	1
	Totals	23 10 0	4 6 6	225 1 1	8

(A) = Dismissed under " Probation of Offenders " Act.

WIRELESS TALKS, MARCH, 1933

<i>Station and Date</i>	<i>Time : p.m.</i>	<i>Speaker</i>	<i>Subject</i>
National :			
March 2	6.20	Mr. A. Hurd and Mr. J. Fox	The Pig Scheme.
" 9	6.20	Mr. A. Hurd	Listeners' Opinions on Pig Scheme.
" 16	6.20	"	Selling Home Produce.
" 23	6.20	"	Ulster's Example.
" 30	6.20	"	Soil Fertility.
North :			
March 11	6.40	—	North Country Farming.
" 25	6.40	—	Agricultural Labour.
Midland :			
March 3	6.40	Mr. W. J. T. Curtis and Prin. H. G. Robinson	The Young Farmer's Policy To-day.
" 16	6.40	Mr. C. Norbury	Spring Spraying of Fruit Trees.
" 25	8.00	Mr. G. Boumphrey and others	"Can We Keep Men on the Land?"
West :			
March 3	6.00	Mr. G. Scott and a Young Farmer	Horses.
" 10	8.30	Messrs. A. W. Ling, A. C. Lanyon and A. Gregg	Sheep Farming.
" 17	6.45	Mr. E. Harvey and a Young Farmer	Cattle.
" 24	6.40	—	Odd Crops.
Welsh :			
March 11	8.05	Discussion	Egg and Poultry Market.
Scottish :			
March 3	6.20	Mr. A. D. Buchanan Smith	Glasgow Stallion Show.
" 8	6.25	Mr. J. F. Duncan	—
" 17	7.40	Mr. R. L. Scarlett	Reconditioning the Land.
" 25	6.50	Mr. Allan Fraser	—
Northern Ireland :			
March 7	7.30	Mr. P. Fitzpatrick	Farmers' Work and Worry.
" 10	8.30	Discussion	—
" 14	7.30	Mr. H. G. Lamont and a Farmer	Pig Diseases.
" 21	7.30	Mr. P. Fitzpatrick	Farmers' Work and Worry.
" 28	7.30	Discussion	"Should Farmers Grow Vegetables?"

FOOT-AND-MOUTH DISEASE

Since the last issue of the JOURNAL the Kent and East Sussex; the Norfolk, Suffolk and Essex; and the Berkshire, Oxford and Wiltshire Infected Areas have been released from restrictions.

Forty-eight further outbreaks of disease were confirmed during the period January 20 to February 18 inclusive. Twenty-five of these occurred in the existing Dorset, Wilts, etc., Infected Area, of which two, viz., at East Tytherton, Wilts, on January 21, and at Netherhampton, Wilts, on January 24, made it necessary to extend the area under restrictions.

Fifteen outbreaks of disease were confirmed in the Somerset Infected Area. Two of these occurred at North Curry on January 31 and necessitated an extension of that area.

Another outbreak was confirmed in the Berkshire, Oxford and Wiltshire Infected Area on January 24, but as there was no further outbreak subsequently in this Area it was released from restrictions on February 15.

Other outbreaks which were confirmed during the period under review necessitated the imposition of Foot-and-Mouth Disease Infected Area Restrictions as follows:—

Essex.—Approximately 15 miles radius round an infected place at Kelvedon at which disease was confirmed on January 22. No further case of disease occurred in the locality and the restrictions were withdrawn on February 13.

Hampshire.—Approximately 15 miles radius round an infected place at Shedfield where disease was confirmed on January 23 and again on February 6. Another outbreak was confirmed at Owslebury on February 7, and, therefore, an Infected Area of approximately 15 miles radius round the new Infected Place was declared. This Infected Area included the area around Shedfield, which at the time of the outbreak at Owslebury consisted of a circle with radius approximately 5 miles in length.

Yorkshire, W.R.—Approximately 15 miles radius round an infected place at Stocksbridge at which disease was confirmed on January 25. This Area included the then existing Area of approximately 5 miles radius round Dore, Sheffield. There was another outbreak on January 26, but as no further outbreak occurred subsequently the restrictions were withdrawn on February 17.

On February 19, Foot-and-Mouth Disease Infected Area Restrictions were in operation as follows:—

Dorset, Wilts, etc., Infected Area. A combined Area of approximately 15 miles radius round infected places at Gillingham, Salisbury, Burbage and Yatton Keynell.

Somerset Infected Area. A combined Area of approximately 15 miles radius round the infected places at Wedmore and Glastonbury, and 5 miles round the infected place at North Curry.

Hampshire Infected Area. Approximately 15 miles radius round the infected place at Owslebury.

Hampshire and Dorset Infected Area. Approximately 15 miles radius round an infected place at East Christchurch, Hampshire, at which disease was confirmed on February 18.

NOTICES OF BOOKS

Feeding Artificially Dried Grass. By S. J. Watson, D.Sc., F.I.C. Pp. 67.
(*Fertiliser and Feeding Stuffs Journal*. 1937. Price 2s.)

This is a report on the feeding of dried grass, prepared for the Grass Driers' Association, and is intended as a guide to the efficient use of this product for farm stock of various classes and ages. It may, perhaps, be unusual to devote a farming book entirely to the use of one commodity. With dried grass, however, two circumstances call for such a book, viz., that it claims attention because it is a recently introduced home-grown feeding stuff that, if produced under favourable conditions, can replace part or all of the concentrates in the ration, and also that, unlike the concentrates that it may replace, it is extremely variable in nutritive value.

The book is self contained, and chapters are included on the nutritive requirements of farm animals, and on feeding standards in general use; the basis of rationing is explained in a simple and effective manner. After a discussion of the nutritive values of the various qualities of dried grass, and the place of this product in the ration, recommendations are made for the different classes of stock according to maintenance and production requirements. Farmers will find these easy to carry out, since the author is obviously acquainted with the practical difficulties of rationing, and recommends systems that can be put into practice on the farm. An appendix is included, giving the results of experiments, and the experiences of practical men. The book is sure to fulfil its purpose; it is full and clear, without being encumbered with too much detail.

General and Economic Botany. By E. E. Stanford, Ph.D. Pp. xx + 675, and 436 Figs. (New York and London: D. Appleton-Century Co. 1937. Price 16s.)

This volume, intended as a text-book for students, is of interest because an attempt has been made to combine the subject-matter that usually appears in elementary botanical text-books with a study of the importance and uses of plants and plant-life to the world in general and to mankind in particular. It is stated in the preface that the principal objective of the volume is "to introduce the student to one great area of the biological world as a larger place to live in, rather than to train botanists to join an overcrowded profession," and that "If the introduction be accomplished in a manner which may to some degree integrate the science of botany with other interests of life to which it should contribute, such as agriculture, horticulture, landscape gardening, agronomy, forestry, zoology, pharmacy, or even medicine, so much the better."

A wide field is covered by the work. The earlier chapters are devoted to a general discussion on "life and living things" and "the plant kingdom." Then follow descriptions of cells and tissues and the different parts of the plant along with accounts of their functions. The various divisions of the vegetable kingdom occupy a large portion of the book, the space devoted to Angiosperms (Flowering Plants) being 140 pages. Here families are arranged systematically, and the more important economic genera and species belonging to them are described or mentioned and the nature of their product outlined. The final chapter is entitled "Evolution, Heredity and Plant Breeding." The writer attempts to initiate his reader into all the botanical sciences or branches of botany.

The book appears to be well prepared and carefully written, and is freely illustrated with drawings and photographs in the text.

NOTICES OF BOOKS

The Nation's Water Supply. By R. C. S. Walters, B.Sc., M.Inst.C.E., F.G.S., M.Inst.W.E., M.Cons.E. Pp. xv + 244, and 78 Figs. (London: Ivor Nicholson & Watson, Ltd. 1936. Price 31s. 6d.)

This description of the water supply of Great Britain is written primarily for members of the general public who are concerned with or otherwise interested in the subject. Although the language employed is non-technical throughout, the book does not claim to be in any sense "popular," and it will doubtless have a value for engineers and meteorologists. The comprehensive nature of its contents will be gathered from the following summary. The work is divided into eight sections, the first three of which deal with rainfall and geological and chemical relations to water supply. The Rainfall Section treats of its distribution with special reference to the average, minimum and maximum rainfall, and also shows how rainfall statistics are used for calculating run-off. The Geological Section deals with those rocks suited to impounding reservoirs and those suited for subterranean supplies. The salient features of chemical and bacteriological analyses are described in Part III. The next three parts deal with impounding, underground and river schemes throughout the country, and the last two with legislation and engineering in relation to water supply. The book is copiously illustrated with photographs, diagrams and coloured maps, which definitely serve to elucidate the text.

The Journal of the South-Eastern Agricultural College. Edited by the Rev. S. G. Brade-Birks, M.Sc.(Manc.), D.Sc.(Lond.), F.Z.S. No. 40. Pp. 188. (Wye: South-Eastern Agricultural College. July, 1937. Price 7s. post free; residents in Kent and Surrey, 4s. post free.)

The wide range of activities carried on in field and laboratory at Wye College is reflected in the new issue of its official journal, which contains articles on apple scab, artificial drying of pyrethrum flowers, brewers' grains as a substitute for millers' offals, conversion of pasture into lawn and cricket ground, "meta-fuel" and slug control, milk cooling, milk production, selection of potato seed, soil detritals, soil profiles and tyroglyphids; and accounts of investigations on machinery used in spraying, and on the insect and allied pests of cultivated mushrooms. As might be expected, there are several articles concerning hops, hop drying, the honey fungus attacking fruit and hops, the downy mildew of the hop, the preservative value of hops of the American type, and a new variety called "Early Promise." The Rev. R. W. H. Acworth contributes an unusual and interesting paper on "Hop Tokens in Kent and Sussex," a valuable collection of which has been presented by him to the College.

Germany: the Last Four Years, an Independent Examination of the Results of National Socialism. By "Germanicus." Introduction by Sir Walter Layton. Pp. 116. (London: Eyre & Spottiswoode. 1937. Price 5s.)

This is, in substance, a reprint of a series of articles criticizing various aspects of the Nazi régime which appeared in the February issue of *The Banker*. According to the introduction, it is the work of "about a dozen men of some achievement in Germany's military, financial and industrial affairs." The subjects discussed include German finances, war preparations, foreign trade, banking, the press, and agriculture. An attack on the agricultural article published by the Berlin Institute for Business Research is reprinted in an appendix, together with a reply by the author of the article.

NOTICES OF BOOKS

Introduction to Economic Botany. By James Gillespie. The New People's Library, Vol. III. Pp. 96, 7 Figs. (Victor Gollancz, Ltd. Price 1s. 6d. cloth, 1s. paper.)

Those who read "An Introduction to Economic Botany" with the expectation of gaining an elementary knowledge of those plants and their products that are most useful to man, will be disappointed. The author of this book is not, in fact, concerned with economic botany in the generally accepted sense of the term, but rather with such subjects as plant diseases, plant breeding and the eradication of weeds. In addition there are chapters dealing with plant anatomy, the chemical basis of plant life, the energy relationships of plants, and growth and development. These aspects of botany are interesting enough in themselves, but to deal with them in a small book on economic botany is both unnecessary and misleading. Brief reference is made to rubber, tea and cotton, but otherwise the reader is left in ignorance of the world's botanical products.

Besides the misleading title there is a great deal in this book that calls for criticism. The anatomical diagrams are extremely crude, and the one of the potato blight fungus on p. 54 is very misleading to the uninitiated, because there is nothing to indicate that the fungus is growing through a stoma in the surface of a leaf. Very little care appears to have been devoted to the arrangement of the subject matter. Thus, on p. 42 we find an account of the morphology of a flower in the middle of a paragraph that opened by referring to Mendel. Then on p. 43, in a fresh paragraph, although the reader has not yet been told of the loss of Mendel's papers, he is suddenly informed that they were rediscovered! Such slang expressions as "dole out" and "suburbanites" seem out of place in a scientific book, and the author appears to delight in the use on all possible occasions of the much abused verb "to get." It is rather surprising to learn on p. 10 that the Industrial Revolution acted as an incentive to the study of plant anatomy; and persons who are familiar with the appearance of tropical rain forests will be amazed to read on p. 73 that they are "ablaze with colour." A statement to the effect that the gene theory of inheritance supports a materialistic philosophical outlook also seems to be out of place in a book of this kind.

That a brief, inexpensive book on economic botany for popular use would serve a useful purpose none will deny, but it is felt that Mr. Gillespie's attempt to fulfil this need leaves much to be desired. The main interest of the book lies in the fact that the author has shown in what directions recent advances in botany may be applied to agricultural or horticultural practice.

